Rock Products
With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Volume XXXVI | Chicago, August 25, 1933 | Number 8

Under the Blue Eagle

WHY should I modernize? asks the signer of a Blue Eagle Code. A fair question deserving a fair answer. And the answer is (1) To reduce costs and earn a profit; (2) improve your competitive position; (3) to provide for efficiency of operation; (4) to make a quality product.

For with reduced operating time, shorter working shifts, fixed minimum wages and at least comparatively uniform wage rates, the only avenue to a possibility of profit lies in the very best mechanical equipment available under the very best of management.

The time-honored method of reducing costs by increasing volume is definitely out. Volume will be limited, perhaps for quite a long time, to a part of your normal plant capacity; you will have to share available business, to some extent at least, with your competitors. Maximum prices will be fixed, by economic pressure, or pressure of public opinion; if not by law; most elements of cost will be fixed. Labor, in all probability, with greater opportunity for employment, will become less efficient. Greater efficiency of plant and management will become all important.

Machinery and equipment that is obsolete, not in years, but measured by the standards of your *best equipped competitor,* is not efficient. Machinery and equipment that has been neglected is not efficient. Machinery and equipment that wastes power is not efficient. Coal, oil, electric power will increase in price, like your own commodity.

Quality of product in a market oversupplied with quantity, or capacity, certainly is going to be more important than ever before. Your machinery and equipment may be relatively new, but if it does not provide up-to-date processing it is obsolete. While demand for their machinery has been low nearly all progressive manufacturers have been more than ordinarily busy devising better methods of processing your materials, or processing to make better products, or for converting former waste products into salable ones.

This "Roll Call" issue of ROCK PRODUCTS is at least evidence of what is taking place. The editors have accumulated as much again material, which deals with process changes and developments of the utmost significance. All this is published not to create business for machinery manufacturers, although that certainly is essential to the success of National Recovery, but if possible to keep interested producers of rock products from meeting early economic death.

For there is one economic law that even the economists of the New Deal do not challenge—"Survival of the Fittest." Economic deaths are going to be less brutal under N. I. R. A. codes of fair competition; but while those who can not qualify under the economic conditions of the New Deal may be eased out more gently and in a more Christian-like spirit, they'll be just as dead when the funeral is over.

Ask Yourself These Questions

(1) Is my production equipment so laid out that the routing of the raw materials or the product is slow and wasting of labor? Is some of the machinery obsolete, because improved models will produce the same output

Rock Products publishers have signed the President's Blanket Code; and have joined wholeheartedly in the attempt to restore prosperity as soon as possible under the N. I. R. A.

—The Editor.

N. I. R. A. Not Intended to Stop Replacements and Rehabilitation

FULLY REALIZING that there can be no substantial increase in employment in many great manufacturing industries without a resumption of capital investment in machinery and equipment to replace obsolete and worn-out plants, General Hugh S. Johnson, Federal Administrator of the National Industrial Recovery Act, answers many inquiries in regard to modernization and rehabilitation of plants as follows:

"I think that the necessary installation of new equipment should go forward. If you stopped inventiveness and progress that would be very stupid. I do think that for a short period it would be wise to not emphasize the installation of machinery that would tend to further reduce the field of employment. But it is not our purpose here to stop economic progress.

"We are going to ask something in the nature of an armistice on increased producing capacity, until we see if we can get this upward spiral started. We can make no hard and fast rule, but we are going to ask these people to pull together to try and get our purchasing power back. We are going to plead very earnestly with these industries not to use any further labor-saving devices or anything to further increase production."

at less cost? (Not necessarily less labor cost; may be your machinery is eating up power and lubricants, or time out for repairs.)

(2) Is my power transmission equipment inefficient—both electrical and mechanical? Am I taking advantage of the progress which has been made recently in electric motors and controls, and in mechanical transmission equipment? (For example, have I studied the saving from the use of ball and roller bearings in much such equipment?)

(3) Is the processing of my products done according to the latest methods? Could a new study perhaps develop new ways to cut costs? (This could be answered rather broadly by reference to the pages which follow, for refinements and changes in rock products processing have been numerous, and in some instances startling.)

(4) Has ordinary maintenance been neglected in my plants during the depression? Is physical property in bad repair? Has idle equipment been robbed of parts? Is deterioration going on unnoticed? Does this waste time and cost money through delay and accidents?

(5) Is my power plant thoroughly modern and efficient? (Will it be cheaper to make my own power than to buy it?)

(6) Is my plant transportation worn out or inadequate or ill chosen for present conditions? Would other types of locomotives, cars, motor trucks, conveyors, elevators, chutes or hoists bring worth while economies?

(7) Is the present use of control and measuring instruments in my plant incomplete? Have new methods been perfected that will reduce waste and increase quality and efficiency?

(8) Are my delivery trucks worn and out of condition, costing too much for maintenance and for operation?

(9) Is my office and inventory storage equipment—bookkeeping, calculating, recording, duplicating and typewriting machines, etc., inadequate or inefficient?

Those questions apply to any business; but the time has come when every rock products producer and manufacturer must answer them positively, for at least enough production is in sight, if not in hand, to justify it. The only way these questions can be answered positively is to have the general manager of operations, or general superintendent, or superintendent check over the entire operation and answer them positively "yes" or "no," and a host of other questions we might ask, but which will suggest themselves to you or to him.

Study Some of These Details

Processing rock products is largely a bulk materials handling problem. The elements are: Plant location and site, layout, departmental layout, relationships and interplant arrangements; production equipment, sequence of operations. If you were building a new plant, with all your present experience, you would take these into most serious consideration and make many improvements doubtless over your present scheme of operation; but you may be able to make many changes to correct some of the faults in the original layout.

In almost any existing plant the proper selection, installation and coordination of adequate materials-handling equipment will lower costs of production, smooth out the production flow, release working capital by decreasing the manufacturing or processing cycle, speed up deliveries and facilitate management or superintendence. Therefore, flow sheets should be carefully studied and every piece of materials-handling equipment selected and placed to fit into the program as a whole.

No one would drive an automobile over 100,000 miles, or beyond its known economic life, for it is universally recognized that maintenance costs then become excessive. Yet much materials-handling equipment in the rock products industry such as shovels, cranes, draglines, pumps, locomotives and cars, motor trucks, conveyors, elevators, etc., have gone far beyond their economic life; but because they can still be used, like a good car even though it has traveled 100,000 miles, their high cost of maintenance is often not appreciated.

Uniform feeding of materials is a feature of all really modern plants, accomplished both by mechanical feeding devices and through the use of surge bins and tanks at strategic places. No piece of equipment in the processing of rock products, be it conveyor, screen, washer, crusher, grinding mill, kiln, or what not, can perform efficiently or turn out a uniform product unless these modern devices to control and regulate feeding of material are installed.

Dust control is another feature that no modern rock products plant neglects. Not only are dusts objectionable to neighbors, but many rock dusts are siliceous in character and lawsuits against employers for silicosis among their employes under compensation laws are costing many operators a great deal more than the installation cost of modern and efficient dust-collecting equipment. And in most cases the dust is a salable or a useful product.

Any part of your plant that is exposed to severe wear or erosion from abrasion, or high temperatures, or both, and is not equipped with wearing parts of one of the many alloys, or special steels, designed for such service, is obsolete and is costing you many times for maintenance and repair what it should. The rapidly growing use of hard-surfacing alloys, which may readily be welded on such equipment at the plant, by your own organization, with either oxy-acetylene or electric welding apparatus, is so commonplace that if you have overlooked this cost-saving feature of operation you may be quite sure your competitor has not.

Instrumental control of processing is going to be absolutely essential in the near future. In nearly every industry quality products can not be produced uniformly and consistently if reliance is placed on manual control of critical operations such as batching, feeding, judging kiln temperatures, etc. Not only quality but continuity of operation suffers unless modern automatic control apparatus is utilized as completely as possible.

All these things are elemental. One might go on indefinitely if he were to get into the particulars of every kind of a rock products' operation.

The question of capital requirement is undoubtedly the most serious problem facing most rock products operators

who are combating the need for plant modifications and rehabilitation. However, a true comparison of manufacturing or processing costs, or facts, against the tax upon earnings due to attempting to operate with obsolete equipment, or even inefficient equipment, should be enough to convince efficient managers that they can not afford delay in many instances.

The Spirit of the N. I. R. A.

While the immediate objective of the National Industrial Recovery Act is obviously to create as many jobs as possible in as short a time as possible at the highest wages possible, one would be absolutely lacking in vision if he could not see that the philosophy behind it is to make industry serve society instead of society being subservient to industry, as it obviously has been. In other words, we are beginning to appreciate that industry was created for the benefit of mankind, not man created for industry.

As the situation develops the ultimate issue becomes more clear. It is a great, perhaps the last great, battle of organized labor to derive all the benefits possible from a mechanized world. In those industries, like lime, crushed stone and gravel, which have had no labor troubles, where the terms "open shop" and "closed shop" have meant little, we have heard little comment on the labor provisions of the N. I. R. A. They have been accepted without question as entirely fair and just. But in those industries like steel and coal, where there have been bloody battles between labor and capital, both sides to the present controversy are quite naturally suspicious that under the N. I. R. A. one side or the other may get some new advantage.

Obviously this is out of harmony with the spirit of N. I. R. A., and may unless curbed dish the success of the whole immediate object, which is universal cooperation to give the New Deal a fair tryout. Yet we can not help believing that the ultimate goal of both capital and labor is identical—the lifting of the burden of unnecessary work from backs of mankind and placing it on machines, constantly more and more ingeniously designed. Once organized labor is in a position to profit from such machinery installations, through more leisure and larger employment in skilled trades making these machines, and we shall see that organized labor is the most ardent advocate of such machinery. During the present transition period, it is natural that the Federal Administrator should want to soft-pedal the labor-saving arguments of machinery manufacturers, but he realizes that this must be for a very short time only, for the President and he are looking ahead, much farther probably than most of us.

To us the chief weakness of their present program is that they are attempting to accomplish overnight what really must be a matter of slow absorption; and too much pressure is apt to stir up a resistance to absorption of new ideas, or rather ideals. However, many of the measures of the Federal Administration are but means to an end—an ultimate goal that must not be lost sight of in the squabble over the means; for the goal is one we *all* want to achieve.

Price and Production Control

The immediate practical aspects of the N. I. R. A., and the various industrial codes which will form a part of it, aside from labor problems, are its effects on price fixing and control of production. There is no denying that much of the enthusiasm of producers for the codes of their industries is founded on the hope that through these codes some legal form of price control will result, and profits will follow as a matter of course. Most producers see an implied promise to that effect in the act, as their reward for concessions in the matter of shorter hours of work and higher wages.

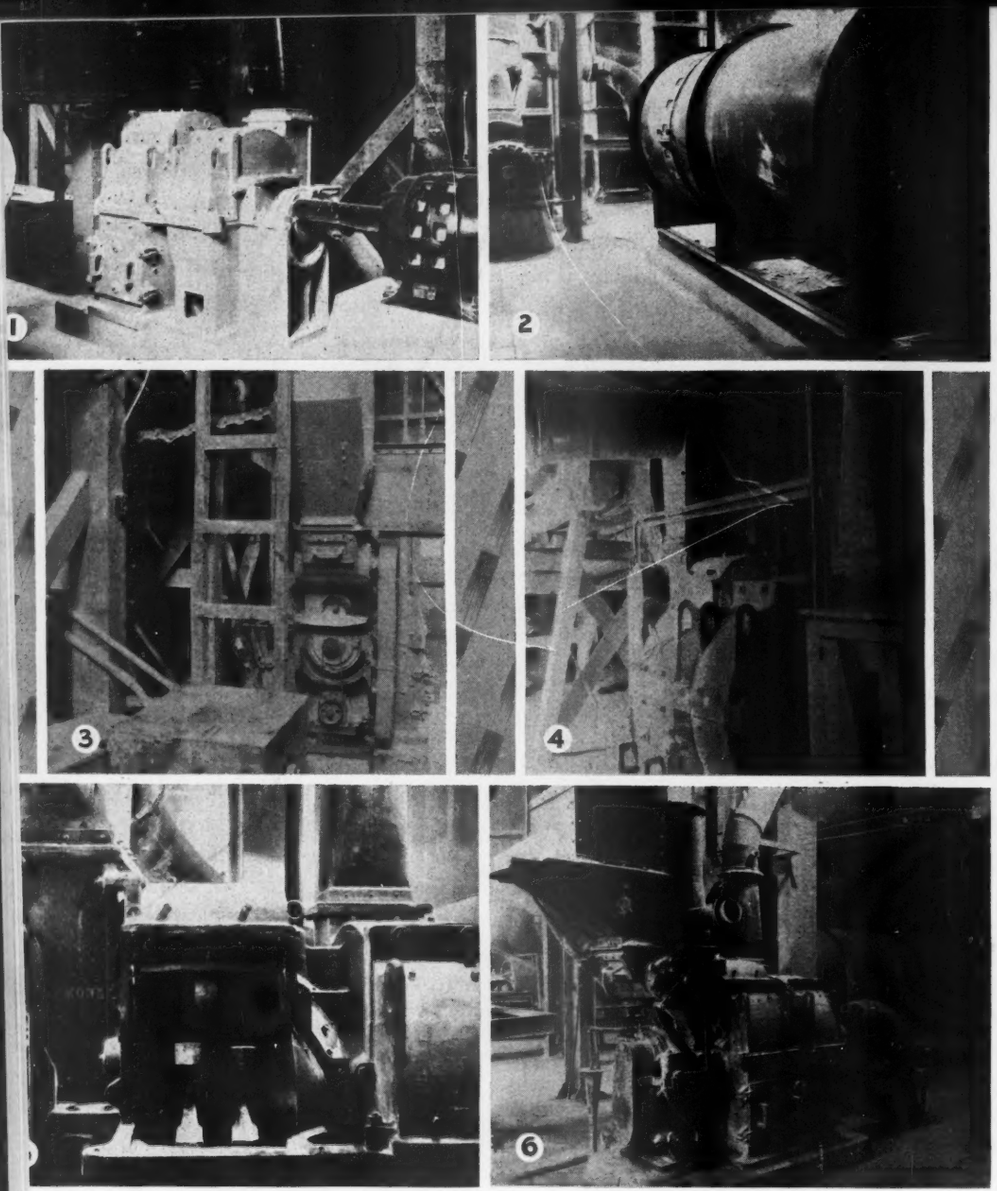
Judging from many remarks by the President and General Johnson there will be every effort made to avoid direct price fixing. Even limitation of new producing capacity is being frowned upon, when specifically written into the codes. The contention is that the promise to prohibit sales below cost under a uniform cost-accounting system is sufficient to cover both price fixing and production control.

In the case of the petroleum industry the insistence on some form of price fixing was too strong to be avoided, but even here the scheme proposed of setting a definite ratio between cost or price of crude oil and the price of gasoline is limited to a test period of 90 days. "Wild catting," which is drilling to open up new fields, is specifically *not* prohibited "because the future maintenance of the petroleum supply depends on new discoveries and new pools," but interstate shipment of oil from such wild-cat wells in interstate commerce, if not in accordance with a plan approved by the President, is prohibited.

If the same reasoning is followed in other natural resource industries, it is plain that unqualified power of an industry to limit its own production is far from being in the picture. And in the case of both the petroleum and the steel industry codes, three representatives of the National Recovery Administration will sit in all control committee meetings where price and production control are finally worked out. In all probability this is to be the standard practice, so there will be no opportunity for "gentlemen's agreements" except in the full light of publicity.

Again and again officials of the National Recovery Administration have suggested that "open price" associations, through which producers operate under standard cost accounting systems and with published price lists, present the most feasible way to take advantage of the N. I. R. A. But these open price associations will have to be in partnership with the government, and have government officials on their committees, directly or indirectly—indirectly, because probably most of these open price associations in the rock products industry will be local; and the control committee of their industry will very likely have to pass on the prices made, and on this central control committee will be representatives of the N. R. A.

In other words the essence of the whole scheme is genuine cooperation of industry for the public welfare. Price increases will not be prohibited, but they will have to be justified beyond all question of doubt.



1.—Dry-while-grinding mill installation at the National Silica Products Co. plant, Lompoc, Calif. 2.—Oil furnace (at right) and dryer-pulverizer (at left) in the Lompoc plant. 3.—Pan feeder, in the Lompoc installation, delivering diatomaceous earth to dryer-pulverizer. 4.—Pyrometer hot-points are in vertical duct, at right, delivering hot air to the mill in the Pacatome Co. plant, Bradley, Calif. 5.—Hammer mill with outer shell removed, showing hammers and other details in the Santa Cruz Portland Cement Co. plant, Davenport, Calif. 6.—Mill in the Davenport plant, which calcines gypsum and pulverizes at the same time

Grinding *and*

By Walter B. Lenhart
Special Representative, Rock Products

AIR SWEPT MILLS of the Raymond roller type have been used in commercial plants as driers for several years, so that, to most readers, such an operation ceases to be a novelty. Heating the air in a separate furnace and then passing the warm, dry air to the roller mill was first used on mineral materials containing a relatively small amount of water. Its use on semi-dry material led to the development of methods and technique whereby materials containing a far greater percentage of moisture could be quickly and cheaply dried and at the same time pulverized. Some of the results obtained on the Pacific Coast on a wide variety of damp to sloppy material, are, to say the least, startling.

The engineers of the Raymond Bros. Impact Pulverizer Co. sensed that, if a product containing 10% water could be dried and pulverized in one operation, a product containing 20%, or even more, might also be. When a 20% product was being successfully dried and pulverized the engineers thought that they were getting some place so accordingly they began looking for new uses for the process.

Someone suggested that if physical moisture to the extent of 20% could be removed, what about removing chemically combined water such as the water of crystallization in gypsum? Pure gypsum has roughly 20% water and is calcined down to approximately 5% water in kettles or rotary kilns, and at all times during the calcining process the material is physically dry. In this process the water of crystallization has to be first broken away from the molecule of calcium sulphate and then evaporated. Essentially it is a double problem of drying coupled with the problem of pulverizing, conveying and elevating, in one operation.

Accordingly, five years ago, arrangements were made to install an experimental calciner-pulverizer at the Long Beach plant of the Standard Gypsum Co. Owing to the relatively high temperatures it was expected to require, the engineers thought it advisable to experiment with pulverizers of the hammer mill type and use the roller mill type for the less drastic drying and grinding problems.

The experimental work was under the personal supervision of William Senseman, western manager of Raymond Bros. Impact Pulverizer Co., and Wallace Riddell, chemical engineer of the Standard Gypsum Co. The work has been carried on intermittently since the mill was installed. The work on gypsum still continues but what is more important to those interested in drying or those who have drying problems, out of it grew ideas, the application of which have solved problems in the whole range of fine grinding of damp or wet materials, be they organic or mineral. It has made available a low initial cost, extremely compact and highly efficient grinding and drying mill that gives results, to say the least, that are astonishing.

When the writer was asked to witness a demonstration wherein sloppy garbage containing a mixture of old vegetables, rancid grease and other obnoxious material was to be dried he was not overly enthused. The material was poured (not dumped) into the mill and a split second later a clean, dry, odorless powder started to come out of the dust collector. The material was dry, not burned, and apparently the cell structure of the organic material was not destroyed. However, before discussing drying and pulverizing other than in the rock products field it might be well to outline the work done in the mineral grinding field.

Santa Cruz Installation

The experimental mill at Long Beach was a small unit but was of sufficient capacity to successfully demonstrate the practicability of the novel idea of calcining and grinding gypsum in one operation. The Santa Cruz Portland Cement Co., Davenport, Calif., was the first to install a commercial plant specifically to calcine and grind gypsum in one operation. A No. 50, "Imp" mill was installed during the summer of 1929.

The installation is a striking example of the necessity of often discarding old, shopworn ideas so as to make room for progressive development in related fields. A brief summary of the work done at Davenport is here necessary to understand the reason for installing a gypsum calciner in a cement plant.

In 1928 the Santa Cruz Portland Cement Co. had installed Hardinge mills with superfine air classifiers for raw grinding. A detailed description of this work was published

Calcining Gypsum *in* One Operation

Installations Showing Other Recent Developments in Drying and Grinding Wet Materials

in Rock Products, June 21, 1930. It met with such success that several more Hardinge mills have been installed.

When the mills first went in on the raw side, observers said in substance, "Well they work on the raw side, but what about finish grinding?" A trial run showed that it worked equally well as a fine grinder of clinker, but it was observed that the setting time of the resulting cement varied slightly.

The Hardinge mill product is air classified and is relatively cool; the heat developed by pulverizing is carried away by the cool air as fast as it forms. Accordingly, it was reasoned that the variations in setting time were due to irregular solubilities of the gypsum. This, it was reasoned further, did not occur in ball or tube mills for these mills usually run hot and the gypsum is thoroughly and uniformly calcined. In other words, the solubility of calcined gypsum is a uniform figure and accounted for the uniform sets.

With this basic requirement in mind a Raymond dry-while-you-grind calciner mill was installed and from the very start was a complete success. Setting times in the portland cement produced became startlingly regular and uniform and the operating problems of the gypsum calcining unit were practically nil. The first set of liners lasted three years and the hammers lasted a year and one-half. The life of the hammers and liners depend upon the amount of abrasive material in the gypsum.

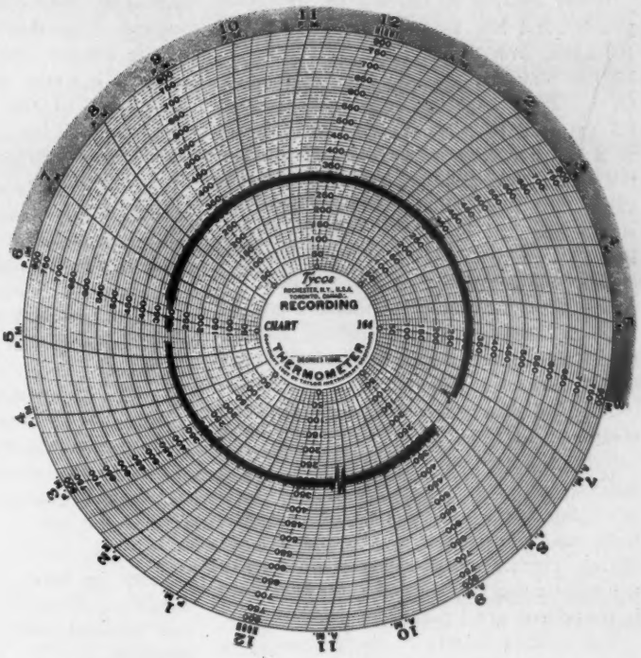
The unit occupies, including the heating furnace, a floor space of roughly 12 ft. by 24 ft., and has a capacity of 2 tons of finished stucco per hour. Oil consumed is 10.7 gal. per hour or 5.35 gal. per ton. A temperature of 425 deg. F. is maintained at the discharge stack of the fan. Temperatures are controlled by means of a "Tyco" recording thermometer supplemented by one of the indicating type. The finished product contains from 3 to 4% water and is ground to 96-98% minus 300-mesh.

Mill as a Gypsum Calciner

From a gypsum producers' standpoint the stucco produced has a fast set, four to six minutes, and probably would require more retarder than stucco produced by the kettle or rotary kiln process. But, this feature has been found to be controllable and the method of control has been patented by those who discovered the method of doing so.

The crude gypsum, in pieces up to 4 in. are fed to the hammer mill and the fan, an integral part of the unit operating from the same shaft as the hammers, picks the material out when it is fine and dry enough to air float and elevates it to dust collectors. The fineness is controlled somewhat by a sliding arm member that is fixed to the fan shaft about midway between the hammers and the fan blades. The white, uncolored gypsum stucco is then fed to the Hardinge mills for further grinding with the cement clinker by Schaffer poidometers.

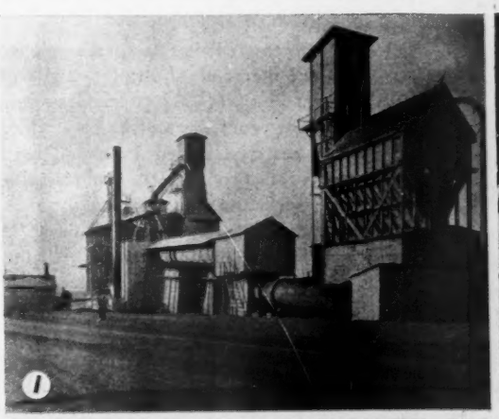
The hot air is introduced into the mill on the suction side of the fan and is obtained from a separate furnace unit that rests a short distance from the pulverizer. The heater is a cylindrical shaped firebox

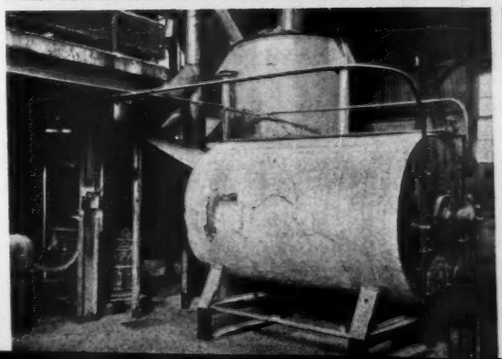


Routine chart of the recording thermometer used to control operating temperatures in the Santa Cruz Portland Cement Co., Davenport, Calif.

Note the extremely uniform temperature possible in this continuous calcining operation

A variety of industries utilize the dry-while-grinding process: 1.—Pacatome Co. plant, Bradley, Calif., showing furnace house at extreme left. 2.—Equipment for drying and pulverizing orange peelings in closed circuit at plant of Exchange Orange Products Co., Ontario, Calif. 3.—Cylindrical furnace and mill (at left) in plant of the California Milk Products Co., Gustine, Calif. 4.—National Silica Products Co. plant, Lompoc, Calif., where diatomaceous earth is processed by dry-while-grinding units





of steel construction and is lined with fire resisting brick. No checker work is used in the fire chamber. A Ray oil burner is used on this installation as well as on all installations described here, where oil is burned for fuel.

When gypsum is calcined by the kettle process and has a fineness of 95% minus 100-mesh, with oil having a fuel value of 149,700 B.t.u. per gal., the oil consumption, on a 12-ton capacity kettle will average 6.5 gal. per ton; hence this unit operates as a calciner slightly more efficiently than the kettles. In addition it grinds and pulverizes the material and conveys it to the stucco bins, all in one operation. W. C. Riddell is authority for the statement that 596,400 B.t.u. are theoretically required to remove 15% of water and make a ton of stucco. Using oil of the fuel value mentioned above, the mill then has an efficiency of 74.0% as a calciner.

The fuel efficiencies obtained here, when compared to some organic materials, that will be discussed later in this article, may appear high; but when organic material is dried the effect of cell structure and cell walls has to be considered as a deterrent to drying. Hence when drying many organic materials a fuel efficiency far less than 74% is considered good practice.

The striking feature of the process from a gypsum manufacturer's standpoint is the extremely small capital investment per ton of stucco produced. This figure will be roughly one-fifth to one-sixth of that required for the kettle process. Also the compactness and small size of the producing units when compared to any other gypsum calcining process.

It is the writer's expectation that the time will soon come when phosphate producers, manufacturers of baking powder, hydroflouric acid and other chemical industries that have a gypsum residue as a byproduct from other operations will find this product amendable to simple and inexpensive processing.

Drying Diatomaceous Earth

When anyone introduces a new machine or a new process or devises a new way of doing something that person is invariably called upon to do things which the conventional machine or method has failed. It is a rare instance that a machine which is a radical departure from standard practice gets a chance to demonstrate itself on simple problems; it has to crack the tough nuts first.

The first person to install a new or untried machine is no ordinary person either, but is usually one who has vision and the "intestinal fortitude" to back his vision with his money. These two conditions were admirably met in the Pacatome Co., Bradley, Calif. It had a drying problem and the company executives had the initiative to deviate from standard practice in an effort to solve their problem. This company, in October, 1928, was the first to install a dry-while-you-grind Raymond mill of the hammer mill type and this installation was the first commercial one in any field.

The Pacatome Co. produces a pulverized and calcined diatomaceous earth which finds an extensive use in sugar filtration work and as an insulator. The raw material is trucked from the company's mine to the mill at Bradley where the raw, run-of-mine material is stored in the open. During the dry season of that section the water content drops as low as 12%, but at no time never exceeds 20%.

The material is crushed at the plant to 1 in. and fed to the No. 50 Imp mill. The mill has a capacity of 2½ tons per hour and pulverizes the material so that it has a fineness of 96% minus 200-mesh. A 50-hp. motor is attached to the mill, but power readings show that only 36 hp. is used at the capacity given. No figures are available as to oil consumed although there are good reasons for stating that, for pounds of water evaporated, the fuel efficiency will be as low as that shown at a second diatomaceous earth plant, a description of which follows this one.

The fan, which is a part of the mill, elevates the dried earth to bins ahead of the Schaffer poidometers as the product, for the uses intended, must be calcined at high temperatures.

The impressive feature of the installation is that the Raymond pulverizer-dryer simplified the operations to the extent of doing away with four of the five bucket elevators previously necessary and, for the first time, produced a product that the mills could use efficiently.

National Silica Products Co. Diatomaceous Earth

This company's mill and mine is at Lompoc, Calif. It operates a diatomaceous earth pulverizing and drying plant. In April, 1929, a No. 50 Imp mill was installed and has been in successful operation since.

The earth treated has a much higher water content than that at Bradley and will run between 40 and 50% water. The discharge product from the mill has 6% water in it. The material is fed 1 in. and fines and produces a product 96% minus 200-mesh. A 50-hp. motor is used on the unit. The mill uses, for a production of 3,000 lb. per hour when the wetter material is used ⅝ bbl. of oil. Fuel oil, having a B.t.u. value of 149,700 per gal., and with a feed containing 50% water, the mill shows a calculated drying efficiency of 72%.

The drying-grinding unit is very compactly arranged in a small space adjoining the sacking room. A Brown recording pyrometer is used to maintain a stack temperature of from 180 to 200 deg. F. The striking feature of this operation is the simplicity of operations and the large amount of old drying equipment practically junked as inefficient when compared to the newer unit.

Uses Outside Rock Products' Field

The two brief descriptions of operations that follow are not strictly, nor even related to rock or mineral grinding and drying problems, but the performance of dry-while-grinding are so striking and the operations so startling that they may point the way for other uses.

The California Milk Products Co., Gustine, Calif., drys and pulverizes milk albumen which has a water content, as fed, of 60% and has a consistency resembling compressed yeast. The discharge product has a water content of 5 to 6%. The No. 40 Imp mill produces 900 lb. per hour of this material with a fuel consumption of one barrel per ton of albumen produced. This fuel consumption shows a drying efficiency of 45.3%. While such a figure may appear low to many, it must be recalled that previous to the installation of this mill the milk albumen either had to be wasted or else dried in trays in steam driers. The fuel efficiencies resulting from tray drying were considerably less than the above and the labor required for handling the trays was a serious problem.

The mill operates at 1800 r.p.m. and is motored by a 25-hp. motor. The material from the mill passes to a cyclone dust collector where practically all of the ground material is collected, there being very little if any dust discharging from the collector. A Tyco indicating type pyrometer is used for regulating the temperature at the fan discharge.

This product is an organic material and in most driers easily might be scorched or burned, thereby reducing its value. The Raymond mill can be operated so that the product comes out almost pure white and free from any dark spots that indicate overheating. At present, most of the milk albumen produced is sold for poultry food so that a strictly white color is not essential. As the small particles of milk albumen are within the mill only a fraction of a second the hot incoming gases do not have time to burn the material. Each coarse particle before it is reduced to a powder contains variable amounts of water, but once the particle is reduced to a small size, the heat that encloses it on all sides dries the particle instantly. The fan then lifts the product out before the material has time to burn.

The Exchange Orange Products Co., Ontario, Calif., as the name indicates, produces various products from oranges, among which is orange juice. By means of screw presses, the orange juice is squeezed from the orange. The balance of the orange, after the removal of the juice is ground in a William's hammer mill equipped with screens having ¼-in. round perforations. This product contains roughly 80% water and is fed to a Raymond Imp mill-drier where 90% of the total water removed is expelled and the orange product elevated to dust collectors.

It has been found that orange meal to be

salable as a stock feed have only about 10% moisture content, so that further drying of the material is necessary. This is accomplished by passing the product through a long rotary kiln where a small gas flame is maintained and the product slowly dried.

While rotary driers are used to finish off the drying they were installed prior to the installation of the Raymond mill, and until the mill was installed not a single pound of orange pulp had been satisfactorily treated. This meant that each day tons of orange peelings and pulp had to be disposed of as waste. This in itself was no simple problem on account of the sanitary problem involved, quickened by the proximity of the plant to residential sections. Hence the installation of the mill made available a product that was previously wasted.

The Exchange Orange Products Co. expects to use the dried orange pulp as a stock food, and it is said to be high in vitamin C. The pulp as dried is not burned or scorched but has a very pleasant faint orange odor, so that other uses as food may be developed for the material. Dried orange pulp also has value as a fertilizer and is an excellent soil conditioner.

In practice at this plant a portion of the discharge from the dust collector is returned to the Imp drier, so that a circulating load is carried within that unit. The portion that is bled from the cyclone falls to a small fan that delivers the semi-dry orange pulp to a separate building housing the rotary driers.

The following figures are the approximate averages taken from results of a 22-day run at this plant: To produce one ton of dried orange pulp containing 8% water 9,900 lb. of orange pulp must be fed to the drying unit. Of this total 7,800 lb. of water is evaporated in both the drying units, of which 7,100 lb. is evaporated in the Raymond Imp mill and 700 lb. is evaporated in the rotary kiln.

Talc and Soapstone Producers Write Code

THE talc and soapstone producers of the United States met in New York August 1 to 3, 25 out of a total of 32 producers, and perfected a permanent organization to be known as the National Association of Talc and Soapstone Producers. The following officers were elected:

President, Michael Doyle, International Pulp Co., 41 Park Row, New York City. vice-president, E. W. Magnus, Eastern Magnesia Talc Co., Burlington, Vt.; secretary-treasurer, J. B. Aikman, assistant treasurer and manager, Vermont Talc Co., Chester, Vt.

A board of five directors was established consisting of the following, in addition to the president and vice-president of the association: Grant Huntley, president and general manager, Alberoid Corp. of America, 153 West 23rd street, New York City; F. F. Farrar, secretary, Cohutta Talc Co., Dalton, Ga.; W. J. Thorn, Innis Speiden & Co., New York and Philadelphia, representing the Pacific Coast Talc Co., 2149 Bay street, Los Angeles, Calif.; Sierra Talc Co., 428 Union League Bldg., Los Angeles, Calif.: Western Talc & Magnesite Co., 1901 East Slauson Ave., Los Angeles, Calif.; Blue Star Mines, 840 San Julian St., Los Angeles, Calif.

Articles of organization and by-laws were adopted. Also a code of fair competition was agreed upon and a committee appointed to present the code to the National Recovery Administration in Washington. This committee consists of the following: Michael Doyle, president; E. W. Magnus, vice-president; J. Frazier Glenn, Georgia Talc Co., Asheville, N. C.

For the most efficient functioning of the organization and code it was decided to divide the membership into regions, viz.: New York, New England, Central Western and Southern States including Pennsylvania and Pacific Coast States. Directors including the president and vice-president of the association were chosen so as to represent the various regions.

Contract Prices and Prices Bid

Lime: City of Sandusky, Ohio, has awarded contract for 600 tons of lime for water-treatment plant to the Marble Cliff Quarries Co., Columbus, Ohio, at $8.10 per ton delivered in carload lots.

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Lime: Kansas City, Mo., received bids for 1,500 tons of lime for water-treatment plant from C. A. Brockett, Abner & Hood Chemical Co., Welch-Sandler Cement Co., Glencoe Lime and Cement Co. (St. Louis), Stewart Sand and Material Co., Barada & Page, Ash Grove Lime and Portland Cement Co., all at $8.45 per ton. The low bid last year was $8.40.

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Cement: Portland, Ore., city council tabled a proposed ordinance requiring bids on foreign and domestic portland cement and authorized the city purchasing agent to buy in the open market until further instructions. The members of the council expressed the opinion that prices for domestic cement were too high and contended that there must be a combine because prices bid were identical from several companies. The mayor and city attorney were directed by the council to submit facts and figures to the Federal Administrator of the NRA on the ground that prices were being fixed under the proposed NIRA code of the cement industry. Local cement manufacturers defended the quotations as necessary because of the shorter work shifts and higher wage scales.

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Cement: Missouri State Highway officials are congratulating themselves on having contracted for 1933 cement requirements last November at a base price of $1.25 per bbl. in western Missouri and $1.15 in eastern Missouri. The state has a $22,773,000 highway program in addition to the $12,000,000 it will receive under the Federal Public Works Act.

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Cement: The North Carolina State Highway Department will not be able to avail itself of a cut-price, two-year contract for 1,000,000 bbl. of cement entered into last summer, but will probably have to pay 50c per bbl. more to take advantage of the new Federal aid funds. Under the NIRA regulations of the U. S. Bureau of Public Roads the contractors must buy their own materials.

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Cement: Belleville, Ill., Road and Bridge Committee of St. Clair County Board of Supervisors awarded contracts for 34,000 bbl. of portland cement at $2.04 and $2.08 per bbl. delivered in various parts of the county. The county has the right to buy 40,000 bbl. more at the same price.

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Ready-Mixed Concrete: Pittsburgh, Penn., county commissioners of Allegheny County, received bids for various zones for delivered ready-mixed concrete ranging from $10.95 to $12.60 per cu. yd. Eight companies made identical bids and stirred up a lot of resentment, but seven were awarded contracts.

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Crushed Stone: Green Springs, Ohio, Sandusky county commissioners have been advised that prices of all sizes of crushed stone have been advanced, except No. 7, or screenings; all sizes are now quoted at 90c per ton delivered, except screenings which are to be 75c. All taxes, assessments or other charges to be paid by the consignee.

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Crushed Stone: Lynn, Mass., has awarded contract for 10,000 tons of crushed stone to the Malden Crushed Stone Co., Malden, at $1.09 per ton.

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Rip-Rap: Savannah, Ga., U. S. Army engineers have awarded contract for 1,400 tons of rip-rap. The low bid was $2.11 per ton, submitted by Palmetto Quarries Co., Columbia, S. C., and Weston and Brooker Co., Columbia, S. C.

Crushed Stone

Ohio crushed stone producers have organized 33 companies, or 85% of the state production, to operate, if possible, under a state code of fair competition, independent of the national group. Ralph Spencer, National Lime and Stone Co., Findlay, is president of this Ohio Stone Producers' Association; Herbert Spencer, France Stone Co., Toledo, is first vice-president; Harry P. Gottron, Gottron Bros., Fremont, second vice-president; J. H. Lincoln, Wood County Stone and Construction Co., Bowling Green, treasurer; W. B. Guitteau, Toledo, secretary.

Possible Improvements in Sand and Gravel Production Methods

By Edmund Shaw

Corresponding Editor, Rock Products, Honorary Member, National Sand and Gravel Association

THE PRESENT sand and gravel industry has been built up wholly by making a better product. A generation ago builders were still going to the local sand pit and taking whatever they found there. Then enterprising dealers began to introduce hand screens and where water was available washing began to be practiced. But even 20 years ago, gravel was looked upon as an inferior aggregate by perhaps a majority of engineers. The great demand for aggregates that came during and after the war gave the gravel producers their chance, and while specifications became more rigid each year the producers met them cheerfully and in many cases of which the writer knows the quality of the materials was kept ahead of the specifications. And for more than a decade gravel has been recognized as equal to any other aggregate, being selected by engineers for some of the largest and most important public works as well as for the smallest buildings.

Now that the construction industry is entering upon a new era it is not to be supposed that this long record of constantly improving the product is going to end. On the contrary, we look confidently for a renewal of effort, because no product is ever 100% perfect. It may satisfy the specifications and the engineering demands of today but tomorrow will be sure to bring changes in the ideas of users which will demand something quite different. And this has been written as a result of trying to anticipate in part what these changes may be and to see how producers may adapt themselves to them. In the main, there is nothing new, at least there is nothing advocated, that is untried, for everywhere producers have been looking ahead and some of the things spoken of here are already well into the experimental stage, even though producers do not commonly use them.

Making More Durable Aggregates

Chief among the topics which have been discussed in recent years by the concrete research men is durability of concrete; its resistance to weather, especially to the severe winters of the northern states. It is fortunate for the producers of aggregates that this investigation was undertaken, for there was a disposition in some quarters to lay every failure of concrete to the aggregates used. Now we have it on the authority of some of the best engineers of the country that at least 75% of the failures of concrete are due to things which the engineer in charge might have and should have corrected at the time the concrete was placed. Still later investigations would indicate that the 75% should be raised to something like 90% if the cement factor, and consequently the water-cement ratio, is controlled by the engineer. For it is certain that the aggregates which will not make durable concrete with a water-cement ratio of 0.8 or less are very few.

Fortunately such specifications as the Federal specification[1] have pushed soundness farther into the background because its sections E-1d (1) and E-2c (2) provide that a record of five years' successful performance is sufficent proof of soundness. It would be a good thing if the local associations which, it is thought, will have so much to say about the conduct of the industry would insist on such a provision in all local specifications. This would save a lot of expensive testing and of argument to establish a point that had already been established by the best of all tests, that of experience.

However, after the ground has been cleared of such cases there is still a problem of soundness for many producers. And each deposit has to be studied somewhat individually because unsoundness results from such widely differing causes.

Ten years ago there was considerable unsoundness due to balls of hard clay, which were hard enough to go through the screening and washing process without breaking, and often did not show up until the concrete was being mixed and placed. These are now eliminated in many operations by the use of log washers or some other device that works on the log washer principle. Hardly more than ten years ago the writer, who was quite familiar with the use of the log washer in the phosphate fields, began advocating its use to gravel producers and found very few of them who had heard of it. Now every producer knows what a log washer is and I am pleased to note that its use is quite commonly mentioned in plant descriptions. The same device and similar devices are also helpful in getting rid of leaves and bark and sticks, thus curing a second kind of unsoundness.

Shale, however, cannot be dealt with in log washers so well, although Huntington writes of cases in which shale was sufficiently removed by a washer of the screw type so that the gravel would pass specifications.[13] But the jig has proven successful in shale removal in the few cases where it has been tried, and where the case is one of getting a better shale removal or abandoning the deposit it should by all means be tried. In a well designed plant the principal expense is that of installation, as neither the power nor the labor cost is excessive.

The cause of unsoundness that seems to be receiving most attention at the present time is soft particles which are called "sand rock," or "chocolate bars," and by other local names. They are structurally unsound and not harmful in small percentages because they do not tend to swell and disrupt the concrete as shale and other clay minerals do.

Hand picking has sometimes kept soft particles down in coarse gravel to a not dangerous percentage but it cannot be used for finer sizes. Recently experiments have been made with a steel cylinder[12] in which the gravel is revolved with a few steel balls, enough to break up the soft particles without crushing the firm pebbles. The soft pieces may then be screened out. I do not know how this has succeeded in practice, but I know the theory is correct because it is the same thing as the Bradford breaker which is very largely used in the coal industry for separating coal from the harder pieces of stone. It will probably require considerable experimenting to adopt the method to gravel, to find just the conditions which will break up the most of the soft particles and not crush the harder pebbles; but it should be possible to work this out.

The one kind of unsoundness that does not seem curable in any way is that which comes from unsound chert. Not all chert is unsound, some of it being eminently sound. But where the unsound kind occurs in a deposit the only thing to do is to abandon the deposit or such parts as contain chert in more than a small percentage.

Unsoundness of Sand

It was at one time thought that considerable percentages of shale and soft particles in sand did not do much harm because the compressive strength tests on such sands were often high. But the experience of years traced certain disintegrations of concrete to unsound sand and now specifications are much more rigid than they were. The Federal specification[1] says that sand shall not contain more than 1% of clay lumps and that the sulphate soundness test loss shall not exceed 10%. Only sands which are almost wholly composed of sound particles can pass such a test, and the corresponding wear test.

Clay lumps in small amount may be disposed of by some scrubbing device. The screw washer has been successful in some plants. There is a new type of drag classifier[3] which should be efficient, one that gives the drags a rising and falling motion. When a drag rises it leaves the sand in a little windrow allowing it to drain. Then another drag comes along spaced so that it strikes

into the windrow as it falls, spreading the sand and scrubbing it and breaking up clay lumps which are washed out by sprays. If this proves as successful as it is right in theory there should be a considerable field for it in the sand and gravel industry, as it would add little to the cost of the plant and nothing to the cost of operation.

Concentrating tables, such as are used in the treatment of ores and the washing of coal, have been proposed for cleaning sand from clay lumps, shale and unsound particles, and they should be efficient for this purpose. The writer has seen notes of their use in Europe and has heard of their being used in the United States. (Elsewhere in this issue is a detailed description of their use at the Cumberland river sand plant of T. L. Herbert & Sons, Nashville, Tenn.) They have had some use in the glass sand industry but not in late years. The reason why they have not come into greater use for cleaning sand is probably that the usual types do not have a high capacity. However, there are special types known as "roughers" and types designed for coal washing that can handle from 15 to 20 tons per hour, which is enough so that it would not take too many of them to serve the ordinary sand plant. It is possible to make the sand tabling section a department that would run 24 hours while the remainder of the plant ran 8 hours, thus keeping down the initial expense. The writer would strongly advise that those having to improve sands by elimination of soft particles and the like investigate the concentrating table. Another advantage is that it could be used to improve grading by discarding some of the excess sizes, as is done at Nashville. And it should remove lignite.

The problem of lignite removal, however, has been satisfactorily solved in some plants by the use of rising current classifiers, now sold as regular equipment by some of the machinery houses.

In addition to positive unsoundness there is the relative unsoundness[3] that exists with some aggregates, especially sands, that have a high water requirement. The resulting uncombined water, as has been shown by Goldbeck and Gonnerman and Ward, renders the concrete easily disintegrated by frost. This is now so well understood that the Portland Cement Association and other authorities recommend that the water-cement ratio for exposed concrete shall not be more than 0.8, or 6 gal. per sack of cement. It would seem a good idea for local associations to insist that this recommendation be followed where the climate makes higher water-cement ratios unsafe.

To sum up as to correcting unsoundness in aggregates, the sand and gravel producer has proven methods for getting rid of clay balls and shale, the log washer and the jig. For soft particles a device similar to the Bradford coal breaker promises well. There should be some experimental work with shaking or concentrating tables, which theoretically should remove all kinds of unsound grains. The designers of such tables would undoubtedly give them the large capacity needed if they could be assured of a market. Lignite is already being removed by rising current classifiers, and trash and sticks may be removed by the same machine, and by screw washers.

More Fines in Sand

A serious problem with some producers and one that promises to become still more serious is getting more of the finer sizes in sand.[4] It is hard for producers to do this even where the fine grains are in the deposit, as practically all plants are built to wash such grains *out*. It is only in the past two or three years that it was realized a certain amount of fine sand is as necessary for the highest strength[5] as for workability.

This discovery came from studying the water requirements of concrete materials. Usually the water requirement depends on the surface area, and as the fine sands had a great surface area the water requirement for them was high. Used by themselves, as everyone knows, they make very bad concrete. But coarse sands have large voids which make a high water requirement, too, and if these are filled with fine sand the water-requirement falls, even though the surface area is increased and the fineness modulus is lowered. There is no doubt about this for although there is little or nothing about it in text books, engineers everywhere are coming to understand it. It is also explained, although rather vaguely, in the Portland Cement Association's pamphlet, "The Design and Control of Concrete Mixtures," on page 21.

The consensus of present day opinion seems to be that there should be at least 10% and better 17-18% of 50- to 100-mesh. There are many deposits now being worked which will not furnish such sands if the material is washed in the ordinary way. In certain localities a business of selling fine sand for an admixture[6] has developed, which seems to me a dangerous practice, for fine sands are a serious detriment if too much is used. Then the producer wants, or should want, to supply all the aggregate that is used on his own job.

In localities where the fine sand exists but is washed out by the plant now it will probably be cheaper to add fine sand saving devices and bring back as much as is required of the fine sand to meet specifications. This, too, would necessitate feeders of some sort. At one plant of which I have heard the fine sand accumulated for years is being collected and fed into the product as it goes to the bin and this seems a very good way to make the mixture.

Where fine sand is scarce and expensive, if there is such a locality, the possibility of grinding sand might be considered. A small ball mill (3½ ft. by 4 ft.) may be bought in Los Angeles for less than $500. The capacity is small but still it might serve to give the needed fines for such a portion of the product as had to have them.

The Federal specifications, at least as originally written,[1] call for not less than 10% nor more than 20% passing 50-mesh. Individual engineers of the Portland Cement Association and some city and county engineers are advocating the adoption of such a provision in building codes. When the public works program gets under way the demand for more fines in sand will undoubtedly be very general and the industry should prepare to meet it now.

Money in Better Grading of Aggregates

The value of more of the finer sizes in fine aggregate is only one of the things brought out by recent studies of the grading of aggregates. Engineering opinion has gone through several changes in regard to grading. After the publication of the work of Feret and Fuller and Thompson it was thought that grading was all-important in determining the strength of concrete. Then the researches of Abrams tended to show that grading was only important because it affected the fineness modulus, and if the fineness modulus was constant the strength would be constant. Further research showed this to be true only in narrow limits and opinion swung toward more exact grading, especially in Europe. Now I believe the best opinion is probably that while it is not necessary to grade strictly to an ideal curve (the best grading being represented by a band rather than a line), grading does very much affect the strength and the workability of concrete. The work of Furnas and Anderegg[8] and Weymouth[7] has shown theoretical reasons why this must be so in bringing out the necessity for "ball bearings," small grains on which the coarser grains can roll, and explaining how oversized voids come from an excess of one size. Both harshness and large voids increase the water-cement ratio for the same consistency, although not proportionately as increasing the area of surface to be covered does.

Recently there has been a great deal of interest in grading in Los Angeles, where I live, owing to the work of Cortelyou,[8] Weymouth, Roalfe and other local investigators. I was privileged to study some of the work done in the laboratory of one of the largest producers, and in a large public works laboratory. They showed conclusively that between concrete made with aggregate as bought on the open market and combined in the usual 1-2-4 proportions, and the same aggregate separated and recombined to a predetermined grading, there was a difference of about *one sack of cement per cubic yard* in strength, or the difference between a 5- and a 6-sack mix. Specifically, the water-cement ratio was reduced from 0.91 to 0.80 for the same slump in a typical test and the workability was much improved. And Cortelyou[8] raised the average of city bridge and highway concrete from 3,630 lb. to 4,320 lb. solely by improving the grading.

Improving Sand Grading

In all these tests it was found that the grading of the coarse aggregate is not so important as that of the fine aggregate be-

cause a bad coarse aggregate grading can be corrected by the use of more sand. This may raise the water-cement ratio, however, if too much sand has to be added. But, if the grading of the sand is such that the mix is harsh and unworkable, adding more sand of the same kind will not help matters. The only remedy is to add fines, and too often the fines have been added as clay or dirt by unscrupulous contractors.

A badly graded sand shows up worse with lean mixtures and it might be said that success with lean mixtures depends pretty much on the sand grading. If it were not that producers have too many sizes and grades to worry about already it might be a good idea to have sands for lean and for rich mixes, as Goldbeck[9] advises the makers of "stone sand" to do. Anyway, the live producer should be willing to make a sand for lean concrete where the size of the order justifies his doing so.

Improving the grading of sand must be by taking away a part of it, unless the producer finds that he can buy fine sand and add it cheaply. But many, if not most sands, have too much of the intermediate sized grains, say from 8-mesh to 30-mesh, and taking away a part of these will be found to improve the workability of the sand and to lower the water-cement ratio for the same slump in many cases. This is already being done in a few plants and it would be done in more if a market could be found for the sand that has to be wasted. The screens and the rising current classifiers that will do the work can be bought.

Every case will have to be studied and handled according to conditions, but I believe that most sand production could be improved by arranging to catch all the fine grains possible, separating into fine, coarse and medium grains by simple screening and classifying devices, and recombining to give as good a grading as the deposit will furnish without too much waste. And the producer who can furnish a sand that will have the same smooth easy working grading, load after load *will get the business.*

The selling of aggregates in two or three sizes has relieved the producer of considerable worry about grading, but has by no means made it unnecessary for him to understand it. Contractors and even engineers ask producers to figure gradings for them, especially where the water-cement ratio or, as is occasionally done in California, the volume of solids per cubic yard is specified. There are still engineers who specify that the aggregates shall have a constant fineness modulus, and this implies some control of the grading. And the producer who sells a part of his product batched, or as ready-mixed concrete, must be thoroughly familiar with the effect of changes in grading of his particular material if he is to get the best results.[10] It is only on the highway job or the job on which a concrete specialist is employed that the producer can feel that the grading of the aggregates is not his business.

Aggregates for Second Class Highways

Every student of social affairs predicts an increase of rural population, and this is borne out by the removal of some 2,000,000 persons from the city to the farm, and the increase of cultivated farms, which is 3% in Pennsylvania, for example. The movement is being helped by the present administration by its revolving fund of 25 million dollars to assist purchasers of farms and in other ways. This new farm population will demand conveniences and advantages that an older generation never thought of, and one of the first demands will be for roads passable the year around. These are likely to be largely second-class roads for two reasons; that they cost less and the money spent for their maintenance is spent in the locality and not sent to some distant city as interest on bonds.

For these secondary roads surfaces graded sand-gravel aggregate,[11] including all sizes from 200-mesh to 1-in. or 1½-in. has been successfully used in road mixes and crushed gravel of the usual macadam sizes has been used in plant mixes. Mattimore[12] says that the Pennsylvania highway department asked gravel producers to make a product for bituminous roads that should be 90% crushed. Some of them refused to furnish it at first, but after making changes in their plants said that they were prepared to furnish a 100% crushed product. It is my belief that careful studies of the gradings for bituminous mixes will disclose that finer sizes may be used so that the waste need not be too serious.

"Artificial" Sands

In localities where natural sand is scarce and gravel is in excess, experiments, some of them in a good sized scale, have been made in crushing gravel to sand, and in one or two instances plants have been successfully operated, at least when sand commanded a high price. A coarse sand for road dressing has also been successfully made. So far as such sands being used for fine aggregate goes, the reports I have received were that while the strength was quite satisfactory the mixes were rather harsh.

It has come to me that this was due to the type of crushers used, which were all, in the experiments that I have known of, of the types that do not make much fines. In fact such machines, jaw, cone and disk crushers and rolls are chosen by engineers when it is desired to make as little fines as possible.

There are machines that will make more fines, and one that is already in use in our industry is the chaser mill, or Chilean mill, as it is known in the mining industry. It has two heavy rollers, at opposite ends of a shaft, running on a circular track. This is very largely used in grinding silica sand throughout the Eastern silica sand fields and has been for a number of years, so all the information needed as to cost, operation, kind and quantity of product made should be available. Judging from the figures in standard text books, taken from grinding ores, the machine would not be too expensive to install or operate in combination with other machines to do the coarse part of the crushing, for the mills of this type are not economical when they are fed with material over ¾-in. diameter, and it had better be ½-in. and finer. I have no knowledge of the machine to enable me to recommend it unqualifiedly, but I believe it should be considered for crushing gravel to sand.

Improvements to Present Plants

The codes adopted, except under special conditions, may possibly forbid plant improvements that will increase output, but it would be against the public's welfare to forbid improvements that improve the quality of the product or that lessen the cost of production. It is expected that the live producer will soon want to improve for both reasons, as the competition of the future must be along the lines of service and quality, with disastrous price cutting eliminated.

The producer who would carry on the traditions of the industry by making a constantly better product will first of all wish to insure the product's freedom from deleterious materials, clay balls, soft rock, shale and the like. Much of the machinery and equipment necessary is already in use and experiments on newer methods promise that whatever else is needed soon will be sold by machinery houses. To meet the fine sand problem there are methods given, and I believe it is far better for the industry to acknowledge that the demand for fine sizes in sand is based on sound theory rather than to try to bluff the engineers out of their position. Above all, I would have producers study the uses of their product constantly, and how such uses are affected by grading, and would have them install such methods and equipment as are necessary to control this important characteristic.

References

The reference numbers in the text refer to the following articles which have been published in Rock Products:

[1]Proposed New Federal Aggregate Specifications for Concrete Aggregates. October 8, 1932, p. 17.

[2]Intermittent Raking Drag Classifier, December 10, 1932, p. 25.

[3]Recent Research on Concrete Aggregates by the Portland Cement Association. March 12, 1932, p. 40.

[4]News Letter—Bootlegging Sand. February 25, 1933, p. 58.

[5]A successful One-Man Silica Sand Operation, January 25, 1933, p. 17.

[6]New Light on the Grading of Aggregates, February 13, 1932, p. 35.

[7]Effects of Particle Interference in Mortars and Concrete, February 25, 1933, p. 26.

[8]Finding the Best Grading for Aggregates, July 30, 1932, p. 13.

[9]Gradation of Stone Sand for Concrete, August 11, 1932, p. 30.

[10]Ready-Mixed Concrete Plant of the Consolidated Rock Products Co., Los Angeles, Calif., June 18, 1932, p. 52-56.

[11]Sand and Gravel Producers Discuss Bituminous Roads, February 13, 1932, p. 73.

[12]Report of Pittsburgh Convention of National Sand and Gravel Association, January 30, 1933, p. 90.

[13]Removal of Shale and Soft Stone from Gravel, November 5, 1932, p. 56.

New Type of Kiln Produces Pure CO_2 and Pure Lime

Cheapens Cost of Making "Dry Ice" Over Present Methods by 75%—Shall Lime Manufacturers Make Dry Ice or Dry Ice Manufacturers Make Lime?

By Earl C. Harsh,
Kelley's Island, Ohio

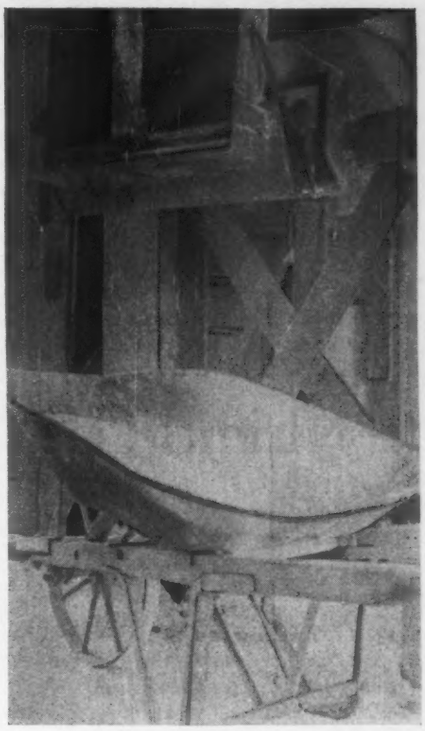
FOR SEVERAL YEARS there has been considerable interest on the part of lime manufacturers in the possibilities of saving and utilizing the waste carbon dioxide gas from lime kilns. Carbon dioxide has a large use in carbonated drinks and a rapidly increasing use as a refrigerant in the form of solid carbon dioxide or so-called "dry ice." This latter field has practically doubled each year for the past five years and amounted to about 135,000 tons in 1932.

Most of the carbon dioxide gas for these uses is obtained by burning coke and washing and purifying the resulting gases, the operation requiring considerable equipment and entailing rather high costs of production, so that the price of dry ice has been quite high as compared with ordinary manufactured ice. The difficulty about using the waste gases from vertical or rotary lime kilns has been that they contain numerous impurities, which must be removed, and are also largely diluted with air, so that the cost of purifying is excessive.

Hence, a new type of kiln or gas generator which makes it possible to obtain the carbon dioxide from the calcination of limestone without any dilution or mixing should be of considerable interest to lime manufacturers throughout the country. This new type of kiln has been brought out by the Gillette Research Corporation, 320 Michigan St., Toledo, Ohio. This company was formed about five years ago to develop some of Dr. Edward P. Gillette's ideas, and work has been carried on for some time on this new type of kiln or gas generator. A hand-operated unit was first constructed and development work carried on over a period of about two years. This was followed by a mechanically operated unit which has now been in satisfactory operation for several months. The operating difficulties incident to any new method such as this have been overcome and data have been obtained as to operating capacities and costs. At the recent convention of the National Lime Association at Atlantic City, Dr. Gillette described in a general way the method used.

Kiln or Gas Generator

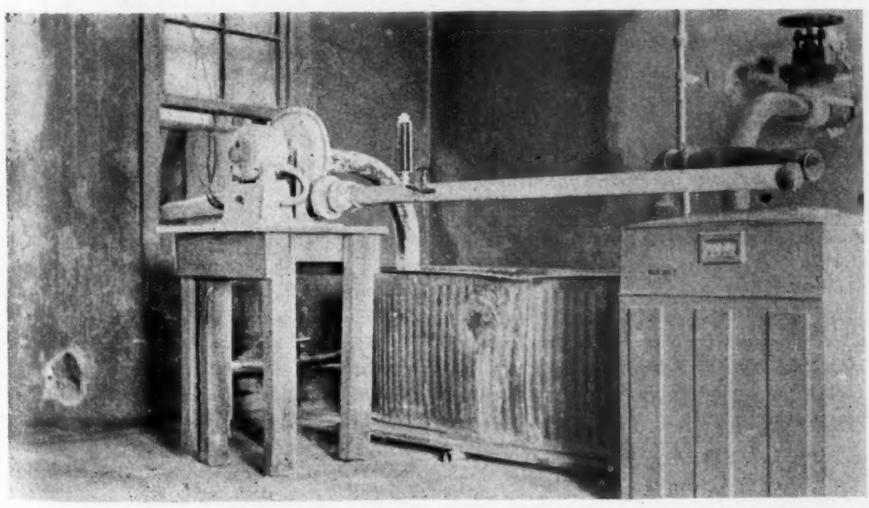
The kiln or generator consists of a vertical calcining tube arranged with a vertical combustion chamber extending up on each side. The calcining tube, which is made up of a special silicon carbide material having several times the conductivity of firebrick, is 3 in. by 20 in. inside and about 24 ft. long. Crushed limestone is fed to a steel hopper at the top and travels slowly down through the tube by gravity, the rate of travel being governed by the rate at which the burned lime is drawn out at the bottom. Below the calcining tube is a short section of steel cooling tube arranged with a rotary feeder which is driven by a fractional horsepower motor through a gear reducer and adjustable pawl and rachet. This permits close regulation of the rate of discharge and hence of the time the material is in the calcining zone.



Lime is drawn from bottom of kiln by a rotary feeder

The heat for calcination is directed against the 20-in. sides of the tube by a tapered combustion chamber on each side and is supplied by two oil burners, one on each side, located near the bottom. Simple oil burners of the air atomizing type are used, which are easily regulated and controlled by a valve and a pressure gauge on the air line. Fuel oil costing 2 cents per gal. has been found satisfactory.

The carbon dioxide gas is drawn off into a vertical header at one side of the calcining tube through a series of inclined holes so arranged that the stone or lime will not be drawn through with the gas. From the bottom of the header the gas is drawn through a pipe and a cooling coil by a small suction fan and delivered for further processing. The only treatment required preliminary to compressing it for the manufacture of dry ice is the removal of the limedust which is done by means of dry bag filters. It has been found that the column



Kiln for dry ice manufacture. Carbon dioxide is delivered here after passing through cooling coils

of crushed stone at the top and the column of lime at the bottom of the tube form an effective seal against air infiltration and numerous tests of the gas by the potassium hydroxide method have shown it to be practically 100 per cent pure.

Various sizes of crushed stone have been burned, from ordinary screenings with the dust and fines removed up to ½ by ¾ in. size. Both dolomite and high calcium limestones have been burned. The temperature in the combustion chamber is about 200 deg. F. higher than in direct-fired kilns to allow for the drop through the walls of the calcining tube. The fuel consumption for a single tube is stated to be approximately 9 gal. of oil per hour and the output of lime about 2½ tons per 24 hours, equivalent to about 85 gal. of oil per ton of lime. This oil consumption is of course higher than in the case of direct-fired kilns, but is more than offset by the fact that a pure gas is obtained which requires no further treatment except removal of the lime dust, and also a pure lime is obtained which is uncontaminated by the fuel or products of combustion. The output of carbon dioxide gas is slightly less by weight than the output of lime, about 5 per cent less in the case of dolomite and 10 per cent less in the case of high calcium stone.

It is proposed to furnish the equipment in standard units which will give outputs of 10, 15, 25, 50 and 100 tons of carbon dioxide gas per 24 hours. The 10-ton unit will thus consist of five calcining tubes in one firebrick setting, each tube having its own individual combustion chambers and oil burners. This method of producing pure lime and pure carbon dioxide gas is very simple and practicable and the operation is easily controlled. The power and labor costs are naturally much less than for ordinary vertical kilns.

Comparison With Present Methods

In comparison with the present methods of producing dry ice it is stated that the total production cost of dry ice can by this method be reduced as much as 75 per cent, this statement being also based on charging the plant with stone at 65 cents per ton and crediting it with lime produced at $4.00 per ton. So great a lowering of production cost would seem to indicate at least some lowering of the price of dry ice with a resultant increase in its use. In addition to much lower operating costs the first cost of the complete plant of this type is stated to be only one-half that of plants using present methods.

Dr. Gillette has pointed out that the lime manufacturers are the logical ones to go into the dry ice business, as they can now by using one of their own materials produce a purer product at less cost than by other methods and at the same time turn a waste material into something that may become even more important than their present major product. It has also been pointed out that the entry of other interests into the field and the establishment of other plants for the production of dry ice and lime would not tend to help the competitive situation any as such plants would probably consider lime as a byproduct to be disposed of at low prices. Stone screenings, now in many cases a waste product, can be used satisfactorily, providing they are as pure and clean as usual kiln stone, by removing the dust and fines.

In going into this business the lime manufacturer would be protected by license in his own territory and would be subject only to a nominal royalty fee, according to the development plan of the Gillette Research Corp.

Lime Plant Progress—What Directions?

By Victor J. Azbe,
Consulting Engineer, St. Louis, Mo.

A MAN who does not strive continuously at improvement is mere ballast in this world. Our economic structure is such that if we do not move ahead we travel backward. While reckless spending is undesirable, reckless saving, if anything, is even worse. It's not money that counts, it's exchange of goods; and "civilization" is gradually stepping up in the elaborateness of our factory equipment, of our home furnishings, of the architectural layout of our communities, of the mode of our own living.

It is not my intention to here advocate reckless reformation of existing lime plants. The cost and sales price of lime, as well as competitive conditions in this industry make this inadvisable, but progress can be had without completely wrecking existing plants and building new ones. A good plant need not be an elaborate plant, whose cost sheet staggers from month to month under the load of high overhead.

The difficulty is that lime manufacturers, until recently, lacked standards of comparison. They neither knew the exact deficiencies of their own plants nor the possibilities. They did not realize that the conventional kiln is in almost all respects wrong, that the plant as a whole may be wrong. The reason for this is that although lime burning in its elements is about the simplest chemical process known to man, the working of a kiln is, on the contrary, extremely complex and to really thoroughly understand the process a man needs to be rather well grounded along several engineering lines.

A conventional kiln of today, its proportions, its operating method, and results obtained could well be classed with steam boilers built seventy-five and more years ago. They also were disproportionate. I may say that the conventional lime kiln of today is wrong in all respects, the shape of the shells is wrong, the lining is wrong, the backing of the lining is wrong, the cooler design is too shallow, the draw mechanism is not right, the hot zone is particularly wrong, the storage zone, the top also. Firing is the crudest, drawing of lime, trimming and punching, too, everything is just about a mile off from right and results in man-killing proclivities, in high fuel consumption; and un-uniform lime quality is in rather close correspondence.

Comparisons Are Enlightening

I will give a few specific examples of good and bad practice to illustrate the rather startling differences one finds in different plants.

A series of five plants, all closely located in a certain lime burning region, had not so long back the following kiln capacities and fuel ratios. The figures are for an entire year's average:

PLANT "A"	TONS OF LIME PER KILN DAY	LBS. OF LIME PER LB. OF FUEL
"A".....	9.16	2.15
"B".....	10.75	2.45
"C".....	10.02	2.07
"D".....	10.50	2.31
"E".....	9.70	1.95

Life of linings varied from only two to about eight months, and these results as lime plants go are in no way unusual.

To illustrate by contrast just what is possible, I will call attention to a gas-fired kiln that was put in operation in a Virginia lime plant early in February of last year—over one-and-a-half years ago. Ever since then this kiln has never been off the line, it never has been repaired, it has never failed to produce less than 40 tons of lime a day, of high calcium lime at that, and lime that purposely was hard burned. It has never failed to give a fuel ratio of better than five to one, and that a net ratio with no boiler coal to be taken in account.

This kiln, which is not such a very big kiln—having a shaft cross-section of about 6x10 ft.—has, since it was put into service, produced considerably over 20,000 tons of lime, and that figure may approach 25,000 tons before it has to be repaired. A record indeed that likely never was equaled before except with the radically different (in principle) mixed-feed kilns.

The reason is proper design, proper refractory, correct installation, proper and controllable auxiliary equipment and a superintendent who believes in putting a certain amount of science into lime burning. I could even talk about kilns with 8 to 1 ratio, but for fear my veracity would be questioned, I will leave the mixed-feed kiln out of consideration.

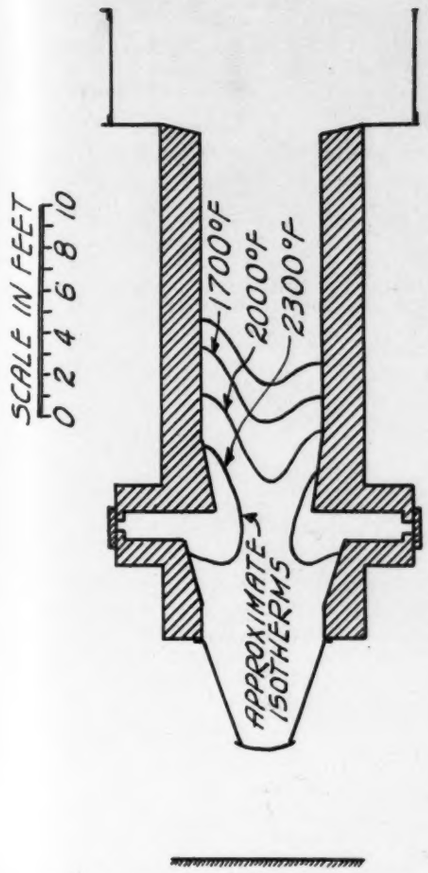


Fig. 1. An antiquated type of kiln all too common in the lime industry

Finishing Lime

Contrasting again, I wish to call attention to the lime-burning region where the stone has the property of producing a highly plastic hydrate. Now every one in the industry realizes that plasticity depends to a considerable extent upon the temperature at which lime is burned and upon the length of time it is exposed to this temperature. To what great extent temperature and time effect the plasticity was demonstrated by R. T. Haslam and E. C. Herman. They showed definitely that 2000 deg. F. and a 4-hour period gave a certain equivalent plasticity, while a temperature of only 200 deg. higher or lower, or a time of two hours more or less, reduced the plasticity to only half. Nevertheless, this district has many small kilns utterly unsuitable for temperature control and for control of flow of lime down through the kiln and for control of gases up through the kiln.

Tests made on those kilns, Fig. 1, revealed that the kiln center at eye level was often 400 deg. F. cooler than the point of flame entrance, that the lime slipped through the cool center giving an underburned product and was held up at the walls causing overburned lime, that along certain elevations gas flames traveled twice as fast than at others. The hydrate with all of this proved plastic—to an extent anyway—but that in spite of rather than on account of the type of kiln and mode of operation. A better kiln certainly would give a superior product.

Just a mere glance at this type of kiln proves that everything is disproportionate in both vertical and horizontal dimensions, some portions ridiculously so, particularly the storage zone. The shaft also, wherein the lime when kiln was drawn, could not be trimmed right at all. Within this shaft the hot gas distributed itself very un-uniformly; where

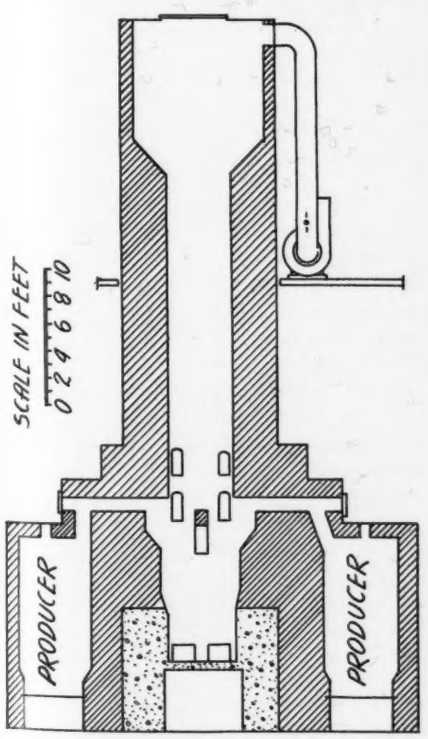


Fig. 2. Kiln equipped with individual built-in gas producers, giving good fuel economy

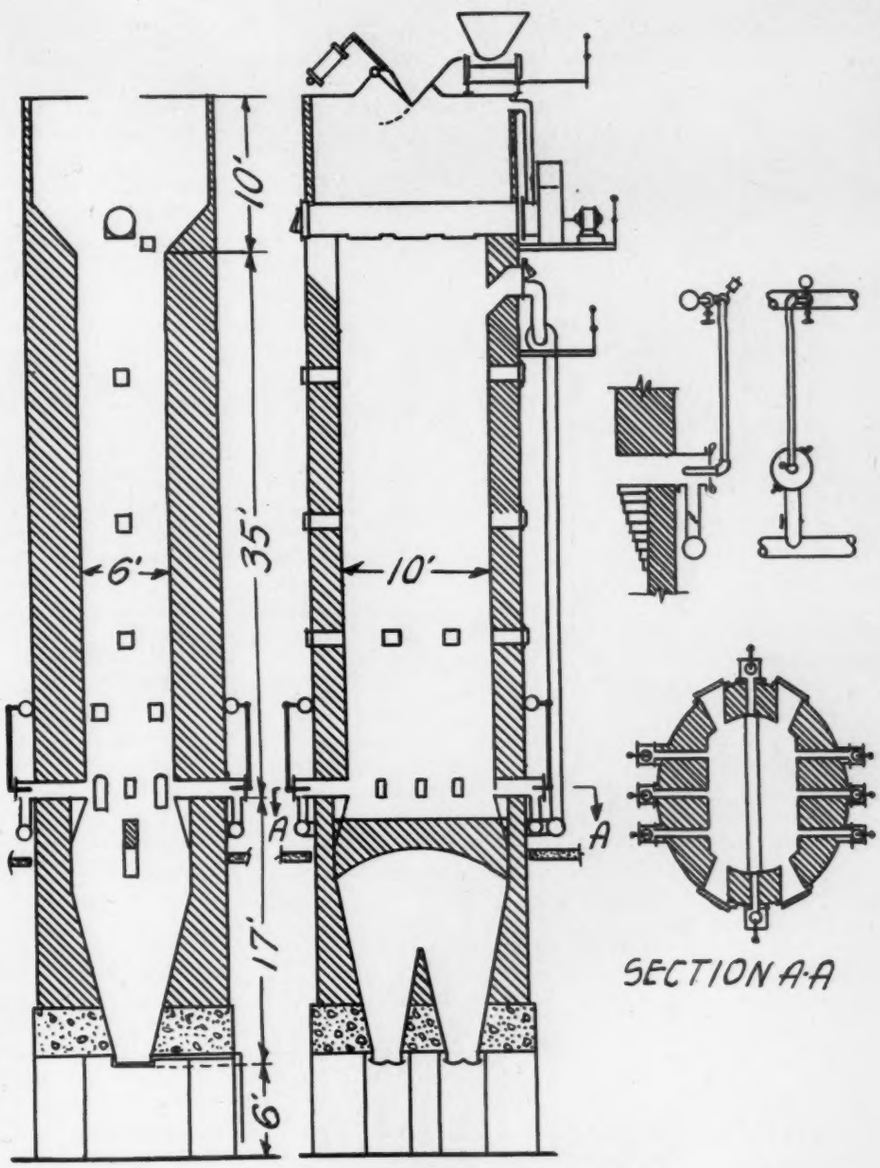


Fig. 3. Kiln designed for natural gas firing, which gives fuel economy commensurate with use of this splendid natural resource

the least heat was desired the most was obtained; and where the lime should have been drawn the fastest, it was drawn the slowest. All so topsy-turvy as to be actually painful to the sensibilities of one appreciating the state of affairs.

Some time long past someone decided that this kind of kiln is *the* kiln for plastic lime; so they were built, acres full of them, while as a matter of fact, a few large kilns would have made all the lime of better and more uniform quality with a much better fuel ratio. For the life of me, I can not see why a ratio of 6:1 with high magnesian lime and good coal should not be common, and even 6:1 means an efficiency not very high.

Large Kilns vs. Small Kilns—Hand Firing Taboo

So many lime men seem to think that high kiln capacity means high temperature, which is not so at all; and that high capacity means dead-burned lime, which also is not so, or not necessarily so, anyway. A large kiln of proper proportions, properly operated, will give a much more uniform lime, much more suitable for special purposes than a small kiln; and this is no guess work. It has been proven.

But, if one is opposed to large kilns, if small kilns are desired, that is no reason why they could not be made efficient. In many plants the kilns could be reconstructed at no very great cost, the cooler made deeper, the shaft made higher, the burning zone so arranged that proper trimming when drawing is a possibility, so arranged that walls can be cleaned of fused-on lime.

If a plant is too small, if natural gas is not available, or too expensive, if too small to justify installation of automatic gas producers, that does not mean that hand firing has to be tolerated as the use of highest grade producer gas is a ready possibility in the smallest of plants. Fig. 2 shows a kiln of Glencoe Lime & Cement Co. equipped with individual producers that give a steady supply of such good gas that no automatic producer could better it. Many analyses were made and never was CO_2 higher than 2.5%, and usually it is below 2%, occasionally even down to 1.5%, while CO is around 30%; which means producer gas par excellence. There is nothing one can condemn more than direct firing of lime kilns. It is under best conditions of most expert firing wasteful.

Fig. 3 shows a kiln a step further along and one designed for natural gas firing. With such a kiln the manifold advantages of natural gas would be realized from this wonderful fuel, which ordinarily is so shamelessly misused. And while on the subject of natural gas it may be mentioned that with it, and kilns of proper design, the burning of spalls in vertical kilns is a ready possibility. There are concerns that do not have rotary kilns, who discard from $100 to $200 worth of good stone a day, that have spall piles containing enough stone to run the plant for years. A spall kiln, due to the large surface that the stone presents, would have an undreamed of capacity.

But repeating, complete change is not necessary to obtain improvement. Still one should do more than be applying mere poultices to a patient that has cancer, or some other major ailment. For lime kilns, about the minimum would be mechanical draft application.

Some Elemental Facts

What is a lime kiln, anyway? It is virtually a chimney clogged up with stone. This clogging will be different with large than with small stone, different with uniform than with un-uniformly sized stone, different with limestone, or lime, that is firm, from one that tends to crumble. The more the blocking the less the draft, and while draft may occasionally be right, it ordinarily is not, and on an ordinary kiln there is just nothing that one can do about it.

As we should stop using direct hand firing on lime kilns so should we stop depending on kilns to produce the draft. Let kilns be kilns and have fans for production of draft, although it will cost a little in power, when properly installed that all will be for the best, the gains will be manifold, and one then will not only have all the draft wanted but will be able to control it at will, and with the use of suitable instruments maintain it always at the desirable point.

The trouble with lime plants is that so many attempts at improvements are undertaken so haphazardly that finally they do not prove improvements at all. Improvements dictated by persons not qualified, not any more qualified than a good general practitioner is qualified to perform a major operation. The most valuable asset a man can have is to know what he does and does not know, to know when to stop, read and listen and engage expert help which we have but do not use. There is more to an ocean than just its surface and it is the same with this technic of lime manufacture.

Long Life for Kiln Linings

Just another example, the Virginia kiln, that has been forced now for over a year and a half, has a lining carefully thought out, part of which consists of very high alumina blocks. The general assumption made by most would be that it is the brick that is responsible for this long life; but that is not so, it is only partly responsible, and the same kind of brick not helped by other favorable conditions would have a life not much longer and certainly not sufficiently longer than average to justify its high first cost. The reasons for the long life are several:

(1) The kilns have a gas offtake submerged in the rock, drawing gas more from the kiln center than its sides, according to designs of Carnot of France, Priest of England, Mount and Azbe of the United States.

(2) The burning zone is so arranged that when the kiln is drawn, the center is retarded, thus maintaining a hot middle, which draws gas better than a comparatively cool middle.

Fig. 4. Instruments needed to test efficiency of a modern lime kiln.

(3) It is possible to hold up the charge until all the lime is cleaned off the lining from above the gas admission ports.

(4) Most air for combustion comes up through the cooler and so temperatures at the eyes are hot but not exceedingly so; combustion is delayed.

(5) A high grade brick is used in block shapes producing a minimum of joints.

Excepting possibly the first item whose extent of influence on life is not certain, any deviation would seriously shorten life.

This was brought forth to illustrate the complexity of the whole and the necessity to have everything right for best results. And while one may do one thing right some other apparently unrelated and unsuspected influence may offset or completely defeat his efforts.

Kiln Tests

To obtain exact knowledge about the performance of a kiln special tests are necessary, which are profitable, but quite difficult to any except a specially trained technical man. He may employ the instruments shown in Fig 4, and his tests may consist of kiln gas analyses with samples taken from different kiln portions, as one kiln section may work entirely differently than another. Producer gas analyses must be made over an extended period also to determine variability. Measurement of lime and flame temperature through the hot zone, measurement of gas temperature at different levels from the top must be made. He may determine variation of temperature from charge to charge, the rise of temperatures through the night and some of his temperature readings will be accompanied by gas analyses taken at the same point, which will enable him to make calculations of the various heat losses. He will measure draft suction, or blast pressure, and pressure drop, that is, resistance of kiln charge. He may even determine moisture in producer gas, or kiln exhaust gas; and he may time the flow of gas through the kiln with the aid of smoke bombs and a stop watch. It is possible that by means of a surface thermocouple the temperature of kiln shells will be determined, and he may go so far as to take photographs of these shells in the darkness of the night with infra red plates, which will reveal hot spots in kiln

shells. He will proceed as the diagnostician proceeds in the large hospital, and determine the patient's ailments, even in hidden organs by inferences drawn from various tests.

But one need not be able to do the above to evaluate the kiln as good or bad. If the lime drawn is hot, the kiln is inefficient, and there are no two ways about it. All efficient kilns put out lime cool enough to be loaded into cars directly. But while hot lime means an inefficient kiln cool lime does not necessarily prove the contrary. There is more to it. Similarly a kiln putting out heavy smoke certainly is inefficient, but a kiln not smoking also may be inefficient for other reasons. If a kiln in the same draw gives hard-burned lime as well as core, if it ever shows any flame on top, if rock is red before charging in the morning, if there is heavy smoke, then no smoke at all, if it takes longer than fifteen minutes to draw and trim kiln, if there is much carbon in the ash, if steam is used for any purpose, all reveal inefficient conditions. Particularly, a kiln in which the middle is not retarded when drawing, can not give truly satisfactory results in either life, efficiency, capacity or quality of product.

The New Competition

During the past year or two there was much talk against efficiency of production, against use of labor-saving equipment, against engineers combating drudgery. The unthinking person wanted to do away with all machinery, wanted to revert to hand labor. He apparently saw no objection in the long working hours of the past, twelve and fourteen and longer. Now we find that there is a far more sensible way out—shorter hours—six hours, who would have dared to think of it only a few years back, although it was certain to come. Fail to balance consumption with production, and all that is left is either shorter hours or men out of work. With the "Economic Machine" regulated by the President, the specter of "Out of Work" turns into comparatively luxurious existence, short hours, plenty time for the enjoyment of the beautiful things of life. The so widely condemned engineer, machine and machine-like methods again regain the prestige in an increased degree.

Lime Industry Has Code Hearing at Washington

AUGUST 8, 1933, may prove a memorable day in the rock products industry, for on this day was held the first formal hearing by the National Recovery Administration for the presentation of a code of fair competition in the rock products industry. Indeed, through the energetic efforts of the president of the National Lime Association, Norman G. Hough, and the whole-hearted co-operation of the association's trade relations committee, the lime industry was one of the first ten or a dozen industries to have code hearings.

Malcolm Muir, president of the McGraw-Hill Publishing Co., was the deputy administrator of the N. R. A. who conducted the hearing. The code was formally presented by President Hough, who made an explanatory statement in which he said:

A total of 144 manufacturers representing 90.4% of total production have studied the code and responded as follows:

133 companies, representing 85.5% of total production, have approved the code.

13 companies, representing 10.9% of total production, have approved the code with one or more reservations, as follows:

3 companies, representing 1% of total production, object to the provisions allowing a sale below cost to meet an established competitive market price.

5 companies, representing 3.6% of total production, object to the hours of labor established as being too low.

2 companies, representing an estimated 6.0% of total production, object to the short length of time permitted for seasonal peaks in the labor regulations.

2 companies, representing 0.7% of total production, object to restricting the use of second-hand containers. One of these companies also objects to the marketing rule on terms and conditions of contracts.

1 company, representing 0.1% of total production, objects to various parts of the code in such a vague way that no sound interpretation of such objections can be made.

1 company, estimated as representing about 1% of total production, withholds approval to all sections of the code until after the President has given his approval.

1 very small company disapproves the code without giving a reason.

156 companies, representing approximately 8.4% of total production, have made no expression.

In view of this analysis of the industry vote, the code is presented with assurance that the lime industry sincerely intends to give whole-hearted support to the administration in its endeavors to increase employment and purchasing power of workers and to stimulate weakened and impoverished American business.

The rest of the address explains special conditions in the lime industry, the difficulties in connection with increasing materially the number of men employed, etc.

Modus Operandi

The code was not read. Those who had objections or suggestions to make had been required to file written notice to that effect before the hearing. These were called on, and if present, presented their points of view in person. If not, their briefs were filed. Occasionally the discussion was made free-for-all.

Besides Deputy Administrator Muir the N. R. A. was represented by labor, consumer and legal advisors, or inquisitors. The first hitch came over the labor provision. These difficulties were ironed out in a few hours by a joint committee of producers, labor and consumer representatives (the consumer representative was a college professor). The 40-hour week was allowed to stand, as was also the 8-hour day, provided the average over a six months' period did not exceed 40 hours per week; all overtime (over 40 hours a week) must be at a rate 1½ times the standard rate.

The minimum wage rate was fixed at 30c per hour in the South and 37½c in the North, in place of 25c and 35c, as the code was drafted. The labor representatives objected to the 10c spread as too great. The producers also agreed to include a sentence to the effect that there shall be an adjustment of rates for skilled labor. (*See page* 98.)

Diesel-Electric Power Plant for Stone Quarrying and Crushing

Hudson River Stone Corp., Cold Spring, N. Y.

By O. J. de Gaetano,
Consulting Electrical Engineer, Mt. Vernon, N. Y.

THE DECISION of the officials of the Hudson River Stone Corp., whose plant was described in Rock Products, December 10, 1932, to use Diesel-electric power was made after a complete analysis of costs of purchased power and/or steam-electric power, had proved that the Diesel-electric method would be the most economical, since the performance of Diesel engines for private and industrial plants can no longer be questioned.

The plant of the Hudson River Stone Corp. has not been in operation sufficiently long to make possible a very accurate or complete study of the power costs. It has, however, been definitely computed that with the present plant design and layout, the cost of electric power should be approximately $0.0125 per kw. hour for an 8- to 10-hour day, based on 4c. per gal. fuel oil and including all interest, insurance, maintenance, operating, depreciation and overhead charges.

During a certain period within the past month approximately 100,000 kw. hours of energy were used. Since the operations during this period were somewhat normal we will use the records applying thereto.

A complete record of fuel and lubricating oil consumption was kept and it was found that 11.57 kw. were obtained for each gallon of fuel oil (28-32 Baumé—equivalent to Shell No. 2) and that the lubricating oil consumption was almost negligible; that is about one quart per 1000 kw. hr.

Installation Cost of Power

This power plant represents an investment roundly of $150,000, of which $110,000 is for Diesel engines and generators, auxiliaries, cooling tower, pumps, switchboard, transformers, wiring, etc., the average depreciation of which is estimated to be written off in 20 years.

The building, fuel oil and water storage tanks, piping, foundations, etc. (all of which are installed at this time for a fourth unit) have an average estimated depreciation which will be written off in 40 years.

From this we find that $6500 per year must be set aside for depreciation.

In order to estimate the kw. hr. cost of the $6500 annual depreciation charge it is necessary to compute the annual power consumption. The following estimate is given:

The present generator capacity is 1500 kw. and when operating on an 8-hr. day with a daily load factor of 80% to 85%, the daily consumption is estimated at about 10,000 kw. hr., resulting in about $0.002 per kw. hr. for all depreciation charges. (This will be materially reduced with the fourth Diesel unit installed when the load conditions warrant, since no additional structure is required to accommodate this unit; the only added cost, aside from the unit itself will be for the small piping and cable connection.)

The interest charges on the $150,000 investment are reduced annually due to the setting up of a sinking fund to cover the depreciation charges of the plant, so that instead of a $0.003 per kw. hr. interest charge, it may be fair to assume a liberal charge of $0.002 per kw. hr.

In a plant of this size the operating staff required consists of one switchboard operator, one Diesel engineer, one oiler and part time charges of the master electrician—all of which is estimated to cost $0.004 per kw. hr.

The average maintenance charges for Diesel engines is approximately $1.00 per horsepower year; resulting from our previous computation in a charge of $0.0001 per kw. hr.

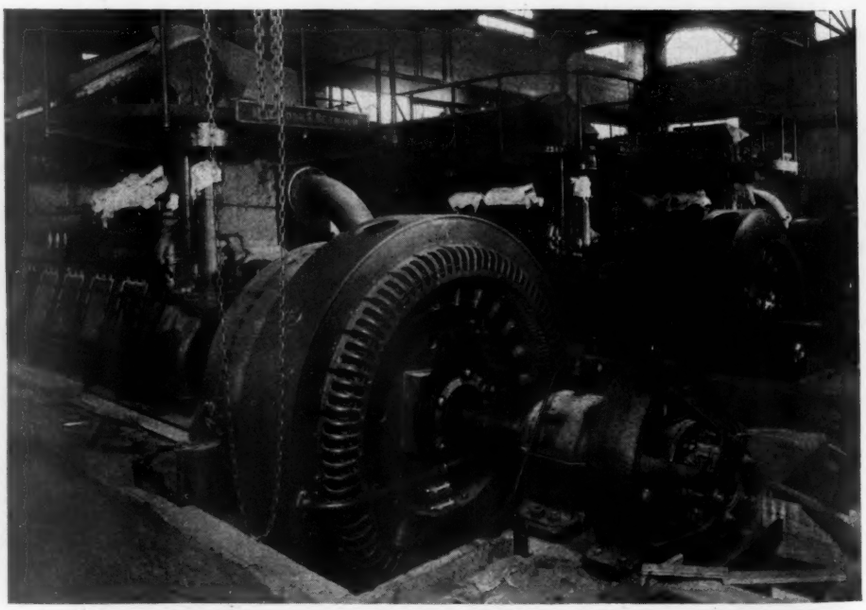
RECAPITULATION—COST PER KW. HR.

Fuel oil cost	$0.0033
Depreciation	.002
Interest (averaged)	.002
Labor (opera ing)	.004
Maintenance	.0001
Total	.0114
Overhead, insurance and contingencies, 10%	.00114
	$0.01254

Say $0.0125 per kw. hr.

From the above figures it will be noted that the installed cost per horsepower for the Diesel engine-generator units, including all auxiliaries, cooling tower, tanks, switchboards, transformers, wiring, pipe lines, structure, foundations, etc., will be about $65 for the ultimate plant layout; all, however, excluding the pro rata cost for the Diesel air compressors installed in the power plant (the present cost per installed horsepower is about $70).

Should it become necessary to operate the plant 14 to 16 hours per day, the kw. hr. cost would be lowered to approximately one cent. This is quite apparent since the interest, depreciation and other fixed charges do not vary whether the plant is idle or running to full capacity.



Diesel engine units in power plant of the Hudson River Stone Corp.

Importance of Power Cost Saving

In stone or ore crushing plants where keen competition is encountered, if the saving in the cost of electric power is sufficient to equalize the payroll or annual interest charges of the entire plant, such an item should be given serious consideration by owners of existing plants, and any who may be contemplating new operations where power rates are higher than those given in this article.

The selection of the size and type of the units is of utmost importance in order to insure the most flexible arrangement for the economical operation of the plant, as in the case of the Hudson River Stone Corp., complete crushing and loading operations may be carried on with three-generators, however, if the crushing load demands the output of the three generators, then one generator at night can safely carry the entire "delivery-barge loading" power requirements.

In consequence, the units selected are rated 660 brake-hp. (sea level rating), 300 r.p.m., 6-cylinder, 4-cycle, solid injection type as manufactured by the McIntosh and Seymour Corp., Auburn, N. Y. All necessary auxiliaries except the circulating water pumps, cooling tower, tanks, piping, starting air compressors, were also furnished by McIntosh and Seymour Corp.

The generators were furnished by the General Electric Co. for direct connection to the Diesel engines, all rated at 625 kva., 0.8 power factor, 500 kw.@50 deg. C., 2300 volts, 3-phase, 60-cycle, and are complete with direct-connected exciters rated 14 kw. at 125 volts.

In order that a more comprehensive description of the plant be given two diagrams or "flow sheets" have been prepared, the one designated as Fig. 1 is for the mechanical equipment and Fig. 2 is for the electrical operations.

Mechanical Flow Sheet

Referring to Fig. 1, it will be seen that three units are now installed with provision for the installation of the fourth or spare unit when the crushing plant load demand exceeds the present requirements.

Each unit is equipped with its own lubricating oil tank, lubricating oil centrifuge with pump and 5-kw. electric heater, daily fuel oil storage tank and starting air tank. In the event of a breakdown, the arrangement is such that the starting air from any tank may be used for any engine by a simple valving arrangement. A similar scheme is also used in connection with the fuel oil tanks, but not for the lubricating oil. (In event of fire in the power plant the daily fuel oil storage tanks may be quickly emptied by pulling the "dump valves" located under the tanks, and the oil spilled in a 1000-gal. outdoor tank.)

The cooling water system comprises:

One 7-tray wood cooling tower (Cooling Tower Co.).
One 1,000-gal. surge tank.
One 10,000-gal. storage tank.
One 600-gal. per min., 45-ft. head centrifugal pump, (supply to Diesel engines—Turbine Equipment Co.).
One 600-gal. per min., 90-ft. head centrifugal pump (suction from Diesel engines—Turbine Equipment Co.).
Two 1,000-gal. hot well tanks.

The sequence of operation is as follows:

The 10,000-gal. storage tank is filled from either river or well water by means of auxiliary gasoline and/or electrically driven pumps.

In order to be certain of the full water supply the 600 g.p.m., 45-ft. head pump is started prior to starting any of the Diesel engines—(by special arrangement with the Utility company, service has been installed so that the two 600 g.p.m. power-house water pumps may be placed in operation before starting up the Diesel engines, thereby assuring the proper water supply for engine cooling. After the first generator is cut in on the bus and the power plant transformers are energized the power supply for the pumps is taken from the station bus by means of a "throw-over" switch.

After the water circulates through the engines it flows to the hot well tanks. As soon as a predetermined level in these tanks is reached, an Electric Controller and Manufacturing Co. automatic float switch cuts in the motor control, thus putting into motion the 600 g.p.m., 90-ft. head pump which forces the water over the cooling tower, from which it returns by gravity to the 1000-gal. surge tank and thence also by gravity to the 10,000-gal. storage tank—thus completing the cycle.

As soon as the low water level in the hot well tank has been reached, where it is apt to break the pump suction, the same float switch cuts off the power supply. This operation is entirely automatic and permits the regulation of water through the engine at will without disturbing the balance of the water supply.

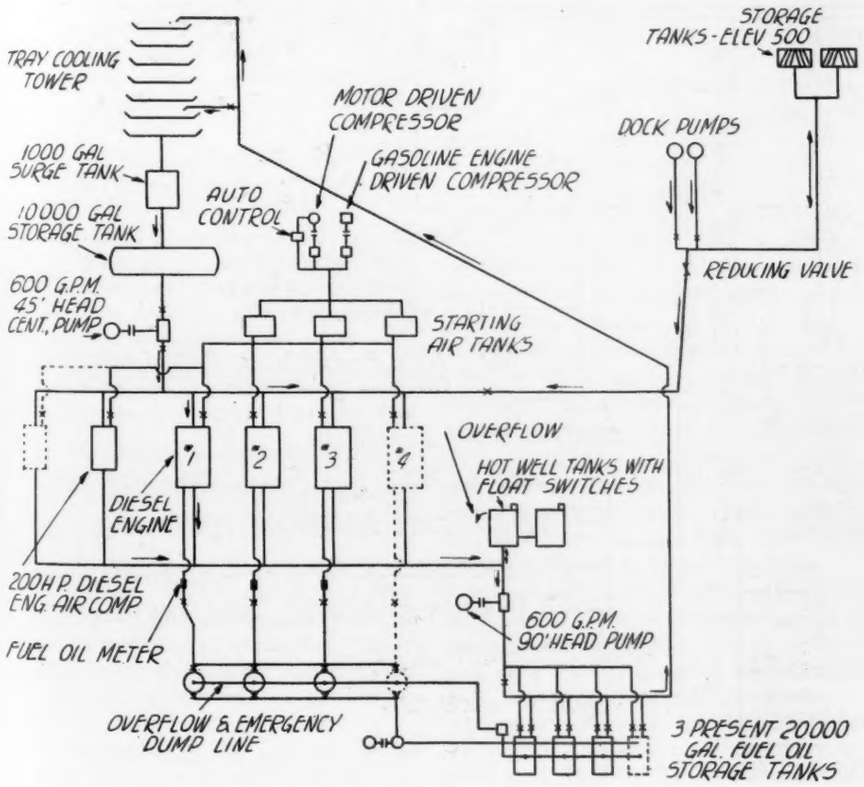
With the cooling tower method it is only necessary to pump each day a sufficient supply of "make-up" water for losses caused by evaporation or unavoidable wastage. This method is also more advantageous, as well as economical, in that it permits better control of the engine jacket temperatures.

During cold weather it is possible to transfer by valving, the hot water from the hot well tanks to the main fuel oil storage tanks, which are equipped with heating coils.

In the event of a breakdown of the circulating water pumps in the power plant, water may be obtained from either of the 8-in. centrifugal pumps on the dock; also a sufficient amount of water is obtainable from the 20,000-gal. storage tanks at elevation 500 ft., so to enable the plant to start up should a complete shutdown occur due to other water-supply failures.

Due to the proximity of severe dust conditions it was necessary to equip the Diesel engine air intakes with suitable air filters and for this purpose the four-unit pipe mounted with steel louvres, were selected.

It may be valuable to state that all of the



Mechanical flow sheet of the Hudson River Stone Corp.

power plant auxiliaries do not consume more than 3% of the total generated power.

For each Diesel engine the following auxiliaries are provided:

One 250-gal. daily fuel oil storage tank, with 2.5 kw. electric heater (General Electric Co.).
One 750-gal. lubricating oil tank with two 5 kw. General Electric Co. electric heaters.
One motor driven lubricating oil centrifuge.
One 5-kw. electric heater (for centrifuging).
One ⅜-in. pump for lubricating from lubrication oil tank to centrifuge.
One starting air tank.

The engine units proper are equipped with all normal accessories such as priming pumps, oil filters, gauges, fuel oil recording meters, etc.

To provide starting air for the Diesel engines when the plant is "cold" or at a standstill, a small gasoline engine, belt-driven compressor has been installed. With the plant in normal operation a small direct-connected, motor-driven Ingersoll-Rand Co. compressor furnishes all the necessary high pressure air for engine starting as well as for the air jack. The control for the 10-hp. motor of this compressor can be made to operate as either full automatic or push-button control at will, by the use of a special General Electric Co. switching arrangement. For the full automatic operation the automatic regulator can be set to start or stop the compressor motor for any air pressures from 0 to 500 lb. The air tanks are usually kept at 250 lb., which is sufficient for several starts.

In addition to the three Diesel engine-generator units and auxiliaries, there is installed a 200 hp. Diesel-powered Chicago Pneumatic Co. air compressor for rock drilling air requirements, with provision for a future unit when conditions are such that same will be needed.

The power plant building is of steel construction, with reinforced-concrete walls, Robinson corrugated roofing, and is provided with a 3-ton hand crane for pulling the engine pistons.

Fuel oil can be delivered to the three 20,000-gal. storage tanks by barges, railroad tank cars or trucks.

In order to save on the construction and installation costs of the piping systems, Creeflex bends, as manufactured by the Pittsburgh Piping and Equipment Co., were used, eliminating the use of many heavy cast iron pipe fittings. Except where it was necessary to match up with standard flanged equipment and valves, Victaulic couplings were specified for all the oil and water lines, and Merco-Nordstrom lubricated plug valves were used in all of the oil lines.

Electrical Flow Sheet

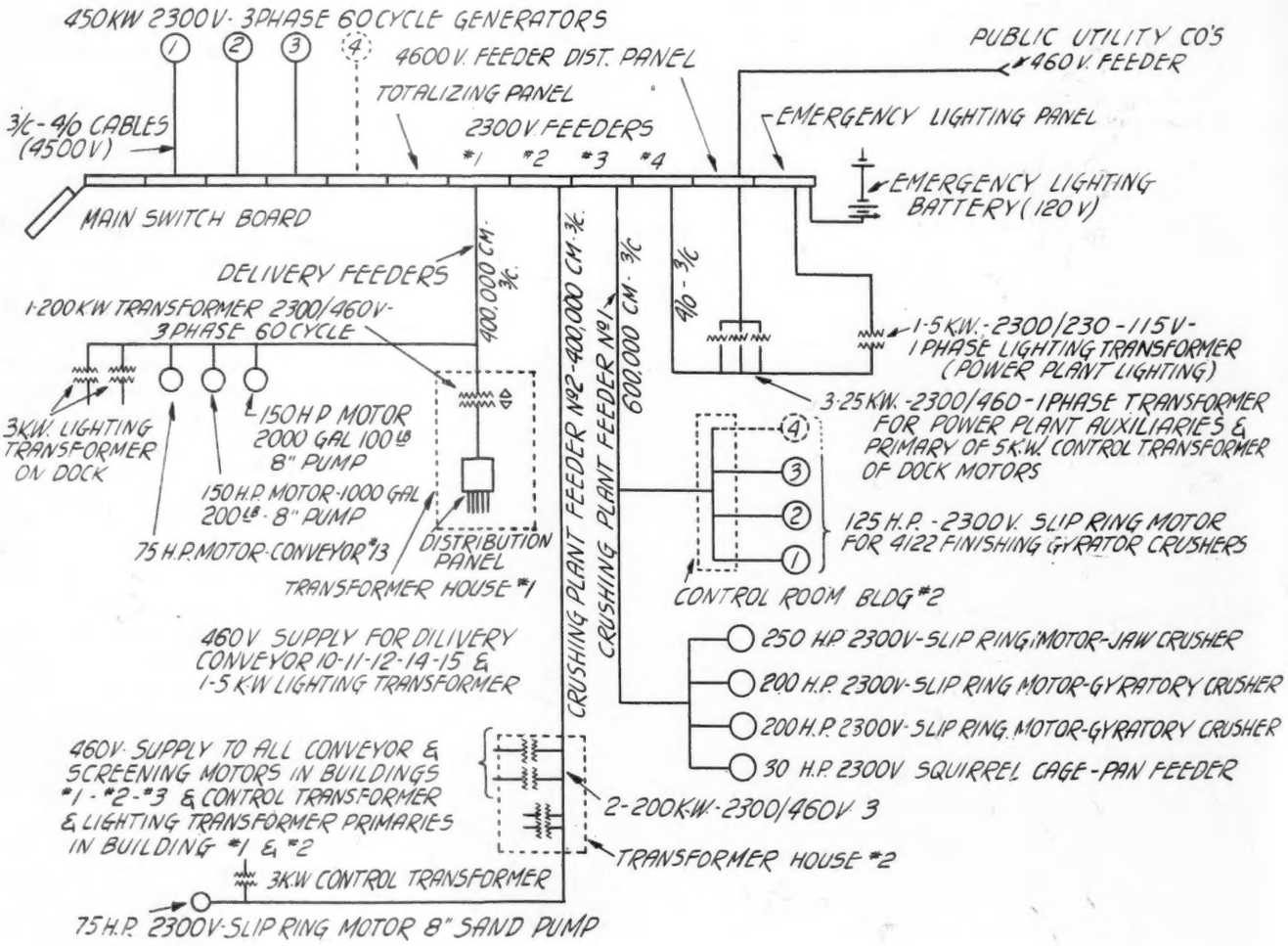
Fig. 2 is a schematic and general one-line diagram showing the general distribution of power.

By examining Fig. 2, it will be seen that the power plant auxiliaries' transformers and lighting transformers as well as the emergency lighting storage battery are all housed in the power plant. These are located in vaults located in the rear and under the main switchboard.

The main switchboard comprises the following:

One swinging panel for synchronizing and bus instruments.
One Tirrill regulator panel.
Four 500-kw. generator panels (one being blank for future generator).
One totalizing panel (total load of all feeders).
Four 2,300-volt feeder panels.
One 460-volt feeder distribution panel.
One emergency lighting control panel.

The switchboard was manufactured by the General Electric Co. and is of the standard


450 KW 2300 V-3 PHASE 60 CYCLE GENERATORS
1
2
3
4
4600 V. FEEDER DIST. PANEL
TOTALIZING PANEL
2300 V. FEEDERS
#1 #2 #3 #4
PUBLIC UTILITY CO'S 460 V. FEEDER
EMERGENCY LIGHTING PANEL
EMERGENCY LIGHTING BATTERY (120 V)
3/C - 4/0 CABLES (4500 V)
MAIN SWITCH BOARD
DELIVERY FEEDERS
400,000 CM - 3/C
1-200 KW TRANSFORMER 2300/460 V-3 PHASE 60 CYCLE
4/0 - 3/C
1-5 K.W. - 2300/230-115 V-1 PHASE LIGHTING TRANSFORMER (POWER PLANT LIGHTING)
3-25 K.W. - 2300/460-1 PHASE TRANSFORMER FOR POWER PLANT AUXILIARIES & PRIMARY OF 5 K.W. CONTROL TRANSFORMER OF DOCK MOTORS
3 K.W. LIGHTING TRANSFORMER ON DOCK
150 H.P. MOTOR 2000 GAL 100 LB 8" PUMP
150 H.P. MOTOR-1000 GAL 200 LB - 8" PUMP
75 H.P. MOTOR-CONVEYOR #13
DISTRIBUTION PANEL
TRANSFORMER HOUSE #1
CRUSHING PLANT FEEDER NO 2-400,000 CM-3/C
CRUSHING PLANT FEEDER NO 1-600,000 CM-3/C
125 H.P. - 2300 V. SLIP RING MOTOR FOR 4½ FINISHING GYRATOR CRUSHERS
CONTROL ROOM BLDG #2
460 V SUPPLY FOR DILIVERY CONVEYOR 10-11-12-14-15 & 1-5 K.W LIGHTING TRANSFORMER
250 H.P. 2300 V-SLIP RING MOTOR-JAW CRUSHER
200 H.P. 2300 V-SLIP RING MOTOR-GYRATORY CRUSHER
200 H.P. 2300 V-SLIP RING MOTOR-GYRATORY CRUSHER
30 H.P. 2300 V SQUIRREL CAGE-PAN FEEDER
460 V-SUPPLY TO ALL CONVEYOR & SCREENING MOTORS IN BUILDINGS #1-#2-#3 & CONTROL TRANSFORMER & LIGHTING TRANSFORMER PRIMARIES IN BUILDING #1 & #2
2-200 K.W.-2300/460 V 3
TRANSFORMER HOUSE #2
3 K.W CONTROL TRANSFORMER
75 H.P. 2300 V-SLIP RING MOTOR 8" SAND PUMP

Electrical power flow sheet of Hudson River Stone Corp.

front manually operated type. The exciter and equalizer rheostats are mounted behind the board, whereas the generator field rheostats are mounted in a vault under the switchboard room floor and operated by chain and sprocket from the front of the board.

The Tirrill regulator maintains uniform bus voltage at all times, whether one or all generators are running, thus keeping the system free of abnormal dips and surges when starting the larger crusher motors.

There is mounted on the totalizing panel a graphic recording watt-hour meter which both indicates and records the total load taken by all of the 2300-volt feeders.

The power distribution over the four 2300-volt feeders is as follows:

(*a*) Feeder No. 1 delivery feeder. This feeder supplies 2300-volt energy to the:

Two 150 hp. synchronous motors for the 8-in. centrifugal pumps on dock.

One 75 hp. slip-ring motor for conveyor No. 13.

Two 3-kw. lighting transformers on dock.

One 200-kw. 2300/460-volt, 3-phase transformer in substation No. 1.

The 460-volt feed from the above transformer supplies energy to all of the 460-volt motors of the so-called "delivery" end of the system, which includes the motors for conveyors Nos. 9, 10, 11, 12, 14 and 15, as well as the primary of a 5-kw. lighting transformer.

(*b*) Feeder No. 2 (crushing plant feeder No. 2). This feeder supplies energy to the two 5-kw. screening plant lighting transformers, one 75-hp. (2300-volt) slip-ring motor for sand pump and the two 200-kw. 2300/460-volt, 3-phase power transformers which in turn furnish 460-volt energy for the 2300-volt motor control transformer primaries, all of the 460-volt motors for conveyors No. 1 to No. 9 inclusive, 16 vibrating screens and two revolving screens as well as for the two 5-kw. lighting transformer primaries in buildings No. 1 and No. 2.

(*c*) Feeder No. 3 (crushing plant feeder No. 1). This feeder supplies energy to all the 2300-volt crushing plant motors having the following designations and ratings:

One 30 hp. pan feeder (squirrel cage type motor).

One 250 hp. jaw crusher (slip-ring type motor).

Two 200 hp. 30-in. gyratory crushers (slip-ring type motor).

Four 125 hp. 412-Z gyratory crushers (squirrel cage type motor—three present, one future).

(*d*) Feeder No. 4 (power plant auxiliaries feeder). This feeder supplies 2300-volt energy to the primaries of the three 25-kw, 2300/460-volt single-phase transformers for the power plant auxiliaries and also one 5-kw. transformer for power plant lighting.

The 460-volt energy is used for all the pumps, motors, electric heaters, centrifuges, etc., in the power plant, and also for the primary of the 460/2300-volt transformer, which is used for energizing the 2300-volt control of the two 150-hp. synchronous motors and one 75-hp. slip-ring motor on the dock.

If necessary, by means of jumpers it is possible to energize the secondaries of the above three 25-kw. transformers from the Utility company's 460-volt service, which in turn can be utilized to furnish 2300-volt power to the bus of the main switchboard, in order that power may be had for testing or trying out any of the 460-volt motors in the plant, or for operating a small tool shop at night when the power plant is shut down.

An agreement has also been made with the Utility company for a maximum demand of 5 kw. for lighting. Circuits are run independent from the owner's supply, so that in event of a breakdown (or night work) there will be ample lighting throughout the entire plant.

It may be of interest to note that the only conduit used in the entire plant (aside from short connecting runs and low voltage circuits as well as lighting) was in the duct bank running from the cable vault in the power house to the top floor in the wash house No. 4 building, and from the generator pits to the main switchboard. This was made possible by the use of a special interlocking steel armored cable, all of which was varnish cambric insulated and lead covered, developed and manufactured by the General Cable Co. of New York, N. Y.

The use of this type of cable facilitated construction, handling and erection to the extent that in less than five weeks from the day the first electrical worker was employed it was possible to run the entire plant.

In the matter of the 2300-volt motor controls, all were either full or semi-"cubicle type," and therefore were installed in groups in dustproof control rooms. All of the control equipment was set on structural steel framework, with checkered plate walkways, 9 in. above the finished floor, which permitted the pouring of all floor slabs and eliminated the use of any conduit runs in the concrete slabs.

The type of cables described above were then run within the steel frames and connected to their respective controls.

Standard 1¼-in. (I. P. S.) pipe framework, with flanges and bolted to the floors, were used for mounting all of the 460-volt power distribution panels, safety switches and motor control equipment, all controls being full automatic, push-button type.

In order to fully protect both lives and equipment a complete grounding system is run from one end of the plant to the other and all equipment grounded in accordance with the N. E. C. standard requirements. All ground wires are bare copper and run in conduits. All motors and control equipment were furnished by the General Electric Co.

NOTE: Since writing this article it was deemed advisable to change the 30-hp. 2300-volt squirrel cage motor for the pan feeder to a 50-hp. 460-volt slip-ring type with a drum controller to obtin variable speed control. This arrangement has proved entirely satisfactory.

Cement Orders Revoked

HIGHWAY department orders for cement have been revoked in Mississippi and Wisconsin because of orders from the U. S. Bureau of Public Roads. The regulations governing the use of the $400,000,000 Federal appropriation for highway construction require that all material purchases be made by contractors. Thos. H. MacDonald, chief of the Bureau of Public Roads, informs ROCK PRODUCTS: "Just after the regulations were issued I had a telephone conversation with a representative of the Mississippi State Highway Department in which I was asked if this meant that the states could not purchase cement and furnish it to contractors, and my reply was in the affirmative. I have since seen some newspaper clippings which are wholly false. I certainly did not order or advise the rejection of the prices bid for cement because they were too low since, in my judgment, they did not offer any advantage to the state and were at least fully as high as cement prices should be.

"What I did say was that the mill prices quoted do not represent in my judgment any material advantage to the states. The Public Works Administration does not wish to be embarrassed by optional contracts for materials of any character. The National Industrial Recovery Act is a sincere effort to create better conditions generally but particularly to offer opportunities for employment.

"The difficulties which face the cement industry are common to all industries, that is, the lack of consuming market. This end will not be reached by increasing prices. If the companies are willing now to make a price for cement which the state may desire to use without obligation on the part of the state, they can certainly without loss make the same price to the contractors when bids are taken for specific projects since this is sure business and optional contracts are not.

"There is a potential cement production of more than 200,000,000 bbl. annually. The peak of cement shipments touched about 176,000,000 bbl. At present shipments would indicate a sale this year of perhaps 60,000,000 bbl. Even though labor prices are advanced somewhat, this does not offer a compelling reason for the advance of prices if the demand for the product increases.

"The real difficulty is not in the cost of manufacture but in the necessity for wider markets which will allow the spreading of overhead, fixed charges, etc., over an increased number of units of production.

"If prices are increased sufficiently this will result not in a larger sale but in a restricted sale due to the competition of other types of materials."

Robert S. Schultz, Jr.

What Is Ahead for Portland Cement?

Several Years of Part Capacity Operation: High Quality and Low Cost Product: More Real Efficiency in Both Individual Plants and in the Industry as a Whole

By Robert S. Schultz, Jr.
Consulting Engineer, Maplewood, N. J.

***THE AUTHOR** is a graduate of the School of Mines, Columbia University, New York City, and has had many years' experience with mining problems. His first contact with the cement industry was in 1912 as engineer in charge of shale mine development for the Atlas Portland Cement Co., Hannibal, Mo. Since then he has held executive positions with the Marquette and Acme (now North American) companies, and served as consulting engineer for numerous others.*

Mr. Schultz writes the editor: "Two problems of cement manufacture—grinding and burning—have been my particular studies, since I have realized that it is in these two features that cement manufacture is and has been farthest away from scientific practice."

AMERICAN INDUSTRY is facing the unknown. The portland cement industry is not an exception. Government supervision? Government control? Government operation? Minimum wages? Maximum hours? Regulated prices? Limited production? Operation by a code? Licensed operation? Who can tell what is ahead? Who can predict which way the trail may lead? The only certainty is that the production and consumption of portland cement will continue.

The portland cement industry has passed through more than three years of industrial depression as a favored industry. Stimulated government construction, national, state and municipal, has enabled the industry to operate at nearly 50 per cent of its maximum recorded production. But this production has been sold at such a ridiculous price that few, if any, producers have been able to show a net profit and many have not been able to show even an operating profit.

This condition has been due more to the accumulated results of a number of years of irrational plant construction than to world economic conditions. Over a long period, the consumption of portland cement had increased rapidly, but production capacity had been increased even more rapidly. For at least ten years leaders in the industry, men of vision, cautioned against a period of overproduction and cut-throat competition. Heedless of such warnings, plant construction continued and the predicted future became the present, even before the economic depression made a bad matter worse.

As far back as 1925 and 1926, cut-throat competition had begun and danger signals were beginning to fly. "Standard Specifications" were increased first and then practically thrown to the discard. To meet competition, companies spent hundreds of thousands of dollars on plant and equipment to improve quality and decrease costs, only promptly to pass any possible earnings from these investments to the consuming public in an improved product at a lower and ever a lower price. Foreign competition made matters worse, particularly along the seaboard. A protective tariff only checked this source of competition. Prices declined, stabilization of prices became unknown and cut-throat competition became general. Then the economic depression hit hard, consumption decreased rapidly and the previous retreat became a rout.

It is unthinkable that such a condition could continue. Overhead has been reduced, inventories have been written down, labor has been reduced, salaries and wages have been cut, depreciation, obsolescence and depletion have been figured to the limit and still there has been no profit.

The cement industry is entitled to a reasonable profit on its product. Except in very isolated cases, such a profit cannot be secured under the conditions generally existing within the industry.

The National Industrial Recovery Act has ended this period and the portland cement industry is facing at least two years of operation under a code, with prescribed and limited production, minimum wages and maximum hours of labor and with regulated prices which are *intended* to yield a reasonable profit. That profit, however, is not guaranteed and it therefore becomes the duty of management to investors to use every legitimate means of insuring that this intended profit shall become an actual profit and shall not continue the losses of the last several years.

Even under government supervision, any intelligent and practical plan for solution of this problem of profits must give serious consideration to, in fact must be based largely on, estimates of the future consumption of cement. The probable trend of future consumption can be estimated only from past experience analyzed in the light of existing and probable conditions.

Through 1928, the industry enjoyed an almost continuous increase in consumption. In that year, shipments reached the unprecedented total of 175,838,000 bbl. Shipments for 1932 were 80,579,000 bbl. or nearly 46 per cent of the shipments for 1928. Shipments for the first five months of this year indicate that total shipments will be about 65,000,000 bbl., but stimulated consumption late in the year will probably bring this total close to that for 1932. Stimulated consumption should be fully available during 1934 and should continue through 1935, but, even under the most favorable conditions, it is doubtful if shipments in those years will exceed 125,000,000 bbl. Such total shipments will mean operation at 70 per cent to 75 per cent of the maximum year and, under reasonable price regulation, should mean some profit for all but the most obsolete plants.

Must Plan for Profit on Curtailed Production

With a total productive capacity of about 261,000,000 bbl., the industry must prepare for several years of limited operations and should plan for such years in methods and costs.

In any plans for the future, the trend of quality of cement must also be given consideration. During the period of cut-throat competition, the consuming public has been educated by the industry to demand high

strengths, both early and permanent, in standard cements at prevailing prices. This same consuming public will continue to demand such cements, and the industry will continue to supply them, without premium prices. It is even probable that there will be a general effort to still further improve quality of the standard cements. The history of the industry indicates this and the amount of research work being carried on, in spite of depression, assures it. The use of special cements will undoubtedly continue to increase. These cements require and should secure premium prices.

The problem before the portland cement industry is essentially twofold:

(1) To convert present losses into future profits.

(2) Assuming present government regulation to be only temporary, to so stabilize the industry, during the period of regulation, that it may continue on a profitable basis without such government regulation.

The conversion of present losses into future profits has been partially accomplished by the general increases in prices even before regulation. Additional increases under regulation go about as far as can be expected in that direction. The other possibility of increased profits is through reduction in costs.

Through the period of rapid expansion in production, we have had many major improvements, mainly mechanical, in cement plant construction. Improved, simplified and consolidated plant layouts; improved and larger mechanical equipment; larger kilns; waste-heat boilers; filters for wet-process plants; blending equipment for dry-process plants; improved machinery for mechanical handling of materials, etc., have all effected material reductions in operating costs but frequently have increased capital costs almost in proportion.

We have now entered a period where capital expenditures, to be justified, must show a very large return on the investment and where process improvements and management must be relied on to secure the cost reductions which must be ahead.

Quarry

The years just passed have developed material improvements in cement quarry practice, but other cost-cutting improvements are either available or are just ahead.

Drilling and blasting, the largest single cost item of the average quarry, are rapidly becoming exact sciences, but, for maximum economy, require careful study, and planned execution. Scientific control of these operations yields large savings. Improved drilling equipment yields greater flexibility and increased footage. Where conditions justify them, gang drills effect large economies, not only in drilling but in both the primary and secondary blasting.

The increased use of Caterpillar-mounted full revolving shovels is frequently justified from an investment standpoint. These flexible machines reduce power as well as labor costs, increase effective loading time and tonnages and largely eliminate the ground crew essential for railroad mounting. Haulage tracks and the ever-present "track gang" are ready for elimination, in many quarries, by motor trucks or tractors, either with or without trailers. Portable air compressors, usually gasoline driven, are eliminating long air lines with their high maintenance and constant losses due to leaks and pressure drop.

The continued improvement in the design, construction and operation of Diesel engines and the practical application of these engines to mobile equipment of various types opens an additional field for economies in quarry costs and may well revolutionize the entire power problem for quarry operations.

Crushing and Drying

In crushing, improved crusher design and new, enlarged and improved equipment are available. "Sizing" ahead of the crushers, both primary and secondary, may prove equally effective at lower capital cost. This plan is particularly effective in plants where crusher capacity is the limiting factor on quarry output. Depending somewhat on the types of crushers in use, reasonable elimination of fines ahead of the crushers can result in an increase in crushing plant capacity as high as 25 per cent to 30 per cent.

Closed-circuit operation of the final crusher (and even in a few cases of the primary crusher) is an important step towards both crushing and grinding economy. While this process yields crushing economy, it is particularly effective in the subsequent grinding operation through the elimination of "oversize" from grinding-mill feed. This elimination of "oversize" and the production of a definitely sized product makes it possible to accurately design the entire raw grinding process and to improve the quality of the resulting clinker at increased kiln capacity and reduced fuel consumption.

With such closed-circuit operation of the final crusher, the determination of the exact size at which to stop crushing and start grinding is a factor of essential importance in the economy of the process. This size is dependent on so many plant conditions that any general rule is impossible. For maximum economy, it is essential that a reasonable balance be secured in both crushing and grinding capacities. In the few plants which are using this process, it has been found practical to make the separation at from 1 in. to ½ in. In some plants using a two-stage grinding process, it has been found practical to make a double separation, with the second separation usually at about 20-mesh, and so by-pass a considerable tonnage around the preliminary grinding unit, direct to the finishing unit. This plan should never be undertaken without a careful analysis of the probable effects of such by-passing on composition.

In dry-process plants, the rock dryers offer opportunities for economy through mechanical draft and efficient dust collection. Where layout makes it practical, material economy can be secured through the use of kiln gases for drying, even after the passage of these gases through waste-heat boilers.

Grinding

The grinding departments, both raw and clinker, offer opportunities for large economies and for improvements in quality at reduced grinding costs. After for fifteen to twenty years of "flirting" with closed-circuit grinding, the cement industry has been forced, unwillingly in many cases, to the economies and advantages of this process, so thoroughly developed by the metallurgical industries. Even now, the advantages and economies of carrying high circulating loads are not thoroughly understood and are seldom applied. Unfortunately, the successful application of closed circuit grinding requires much more than the purchase of separating or classifying equipment. It requires a knowledge of fine grinding in both theory and practice; a knowledge of grinding equipment; of grinding media and of separators and classifiers. It necessitates a carefully detailed study of the entire grinding process from preliminary feed to finished material; a knowledge of the materials to be ground, of their fracture, of their grindability in both the preliminary and finishing stages and of their relative grindability in these stages, as well as a knowledge of the product desired, of its fineness through the entire micron range, of the qualities it must possess and of the effect of fineness on those qualities. It requires an accurate determination of the amount of grinding to be performed in the several stages; of the amount of work which can be performed by the units available for the several stages and of the effect of circulation on this grinding capacity. All of this information is essential for an accurate solution of grinding problems looking towards maximum grinding economy in a balanced installation.

The practical development of the air analyzer has made it possible to secure close knowledge of finenesses below 325-mesh and to determine the effect on quality of product due to variations in these finenesses. The accurate determination of micron sizes adds greatly to our knowledge of fine grinding and has eliminated guesswork in this field of essential importance. This knowledge of micron sizes is equally important in the grinding of raw materials and of clinker.

The cement industry has barely started to reap the benefits possible through closed-circuit grinding in conjunction with stage reduction. Two-stage reduction has become common again, three-stage is in operation and four-stage is practical under certain conditions. The maximum advantages of stage reduction can be secured only by accurate sizing and separation between the stages and the accurate design of the grinding units for the work to be done in each stage. All of this can be accomplished, frequently, through minor changes in existing grinding machines, with the addition of the classifying equipment.

Dry grinding of raw materials has a con-

siderable advantage over wet grinding in the relatively lower first cost of the classifying equipment for very fine materials. A considerable portion of the economies and improvements in quality possible through the use of separators and classifiers for fine wet materials can be secured at less expense through closed-circuit operation of preliminary wet grinding units with vibrating screens. For separations as fine as 30-mesh, these screens are satisfactory and are about equally efficient either wet or dry.

The Kiln Room

The kiln room, with its adjunct, the coal department, where coal is the fuel, offers probably the greatest present-day opportunity, in the usual cement plant, for large economies. Essentially, the process of burning cement clinker is the same today as twenty-five years ago. Kilns have been increased in size, both in diameter and length, and in strength; some mechanical improvements have been made, particularly in wet process kilns; coal feeding has been improved and some attempts have been made to use greater or less amounts of preheated air for combustion, but the burning process still usually consists of blowing the fuel into the center of the kiln opening, usually at high velocity, with a small portion of the air necessary for combustion and depending on draft, either natural or mechanical, to supply the balance of the required air in the necessary quantity and at the exact time and place essential for economical combustion. Present-day knowledge of combustion, and particularly of combustion in cement kilns, does not warrant the continued use of this system.

For ideal combustion, it is necessary for the fuel to be reduced to infinite fineness; for the fuel and air to be preheated to the ignition temperature of the fuel and for the fuel and air to be brought together in correct proportions and as a perfect mixture at the end of the burner pipe. This ideal is not practicable, but the closer it is approached the higher is the combustion efficiency.

The so-called "low pressure burning system" which has been slowly gaining acceptance for a number of years in the cement industry, and now is in use in a considerable number of plants, is a long step towards such maximum economy in burning. This system, which has been applied with about equal efficiency to kilns using coal, fuel oil and natural gas as fuel, mixes from 90 per cent to 100 per cent of the air required for combustion into an intimate mixture with the fuel just before admission to the kiln. This gaseous mixture is blown into the kiln at a velocity sufficiently above the velocity of flame propagation for the particular mixture to prevent back-firing, but slow enough to burn in a short zone of high heat intensity, close to the nose of the kiln. The use of preheated air, up to 500 deg. F. or 600 deg. F. is desirable for maximum economy, but is not essential for efficient operation of the system. This burning system produces a clinker of superior quality and permits operation of the kiln at maximum capacity for days at a time without attention from the burner, other than occasional inspection, or adjustment of the burning conditions.

Such low pressure burning systems must be designed to fit the conditions and requirements of individual kilns. They can be designed either for maximum fuel economy at high kiln capacity, or for maximum kiln capacity at high fuel economy, or for a medium between the two. Where this low pressure system has replaced the more usual high pressure system, kiln capacities have been increased 15 per cent to 25 per cent and fuel consumption has been decreased in about the same percentages.

The uniformity of operation of kilns using the "low pressure" burning system and the practical development of indicating and recording pyrometers, CO_2 meters, draft gauges, tachometers and similar control instruments makes it possible to operate cement kilns as accurately and as efficiently as boilers using pulverized coal in large, central power stations. It is entirely practicable to place kiln operation in the hands of skilled chemical engineers operating from a control room at greater or less distance from the kiln hoods and with only occasional visual inspection by a greatly reduced kiln room force.

Heat absorption from kiln gases to raw mix in the back end of cement kilns is proportional, among other factors, to the time of passage of the raw mix through the kiln and to the number of times the mix is turned over during such passage. Due to the large and unobstructed gas passage and to the rapidity of gas travel, the rate of heat absorption is low. Increased length of kiln naturally increases total heat absorption and hence increases both kiln capacity and fuel economy. This may be the simplest and most economical solution of the problem for new kiln installations, but it is seldom economically correct for existing kilns. The use of chains suspended in the rear end of wet-process kilns, as developed by one manufacturer, not only prevents the formation of "mud rings," but aids greatly in heat absorption. There appears no reason, except difficulties due to higher temperatures, why such chains should not be used effectively in dry-process kilns. Other satisfactory means of increasing heat absorption will undoubtedly be developed.

Successful application of vacuum filters for partial removal of moisture ahead of wet-process kilns has increased kiln capacity and reduced coal consumption. It has gone a long distance towards equalizing the difference in kiln-room operating costs between wet- and dry-process plants. A further development, awaiting only the fully practical development under operating conditions of the necessary dryer, is the installation of low temperature drying machines ahead of wet-process kilns for complete drying of slurry before feeding to the kilns. This step will increase kiln capacity and reduce fuel consumption in wet process plants to practical equality between the two processes. Possibly spray drying, worked out so successfully in other industries, may be the solution of this problem. It is understood that this process is in use, at least experimentally, in one European plant.

Recent developments in the design and construction of unit coal pulverizers, of waste-heat dryers and particularly of pulverizers using preheated air for at least partial drying have spelled the doom of the "coal room." These pulverizing units are now so satisfactory in operation and their product so satisfactory from a burning standpoint that their installation either as units with individual kilns or with intervening bins has become both practical and economical. The use of unit pulverizers is particularly advantageous with the "low pressure" system of burning.

Shipping

Bulk shipping of cement has been tried, more or less experimentally, for many years. The development of satisfactory shipping carriers and particularly of satisfactory loading and unloading equipment has made this method of shipping very attractive on large contracts and to centralized points of large distribution. It has been particularly attractive where water transportation has added economy. Much of the bulk shipping to central distributing points has been due to the excessively competitive sales conditions of the last several years. With the less competitive conditions prescribed for the immediate future, it appears probable that shipments to distant distributing points will be at least curtailed.

Bulk shipments of clinker to centralized grinding plants, particularly in metropolitan areas for truck deliveries of cement or of ready-mixed concrete, appear to be gaining in favor.

Decision between these two methods of bulk shipping should be decided, in each case, by a detailed economic study of all the conditions. Under proper conditions, bulk shipping offers material economies. Probable adjustments of railroad freight rates will have a most important bearing on this problem.

The above summaries have outlined only the major improvements and economies which are immediately available, many of them with comparatively minor alterations and at relatively small capital investments. Many of them can show annual returns of 50 per cent to 200 per cent on the necessary investment.

Economic Problems

The second phase of the problem before the portland cement industry, permanent stabilization, does not have a definite and known solution. However, if present government regulation under the National Industrial Recovery Act be but temporary, future stabilization of the industry and profitable operation must depend on the industry itself.

There appear to be three general means for solution of this serious problem: (1)

consolidation; (2) co-operation; (3) elimination. Probably all three means will contribute to its solution.

CONSOLIDATION, already accomplished, to a considerable extent, can be carried farther to the advantage of the industry and to the ultimate advantage of investors in cement securities. How far such consolidation can be carried profitably is a question for most serious consideration. The wide scattering of the industry and yet its general grouping in a number of districts adds great difficulty to any plan of consolidation which can be effective in solving the problem of stabilization. A considerable amount of consolidation has been in effect for years but has not been sufficiently effective to prevent the cut-throat competition and non-profitable operation of the immediate past. How much additional consolidation would have prevented these conditions can only be estimated; probably more than would have been either practical or legal.

The wide and general distribution of deposits of suitable limestone and clay adds greatly to the problem of consolidation. With normal consumption and reasonable profits restored, without regulation, we may expect additional cement plant construction, additional production and cut-throat competition. Consolidation, alone, cannot prevent this condition.

CO-OPERATION is a plan of great possibilities but also of great difficulties. It is a plan which has been tried repeatedly in the industry but which has failed just as repeatedly. It is a plan which works well as long as production and consumption are in reasonable balance but rarely works at all when consumption decreases materially below production. Then, some producers always expect to continue operations at near full capacity but expect competitors to decrease their production sufficiently to balance production and consumption in their particular districts; and, if a district will not absorb the output, immediately go after business in adjoining districts. The next step is a cut in price to get some particular job, then a general cut in price, then more cuts and finally no profit.

It is to be hoped that the lessons of the past several years will have been sufficiently well learned for the cement industry to avoid such pitfalls in the future. For an industry as loosely jointed as the cement industry, co-operation is the only way to profits when consumption falls materially below production. It appears evident that the laws against effective co-operation are to be greatly modified and liberalized and that co-operation, probably under government supervision, will be favored if not made mandatory. This is a great hope for the future.

ELIMINATION can be accomplished automatically by allowing the situation of the immediate past to continue. It was already well in process. In spite of enormous investments and large reserves, no industry can continue to operate indefinitely at a loss. Obsolescence is an additional factor and, with its aid, ultimate stabilization is unavoidable. The survival of the fittest is as hard an economic law as a natural law and just as inevitable.

Between these three possible means, ultimate stabilization must be reached. Some plants will be consolidated. Some degree of co-operation must be effective, even without government regulation. Some production capacity will be eliminated.

But even without consolidation or co-operation, the situation is far from hopeless for those companies that are awake to the possibilities and are willing to take advantage of the practical economies and improvements which present-day knowledge presents to the portland cement industry. To produce the highest quality cement at a cost which will not only meet competition but will meet it at a profit to the producer, it is essential for management to take full advantage of cost-cutting improvements which will pay their way, and to operate without paying enormous annual tribute to obsolete practices and inherited traditions.

Ready-Mixed Concrete Producers' Code

UNDER the auspices of the National Ready-Mixed Concrete Association a meeting of producers was held in Washington, D. C., August 10, at which a code of fair competition was adopted. It was by far the most important gathering of ready-mixed concrete producers ever assembled. Some 37 companies were represented in person or by proxy.

The code adopted sets up seven administrative regions. The National Administrative committee will be composed of one representative from each region. The code provides, as is the case with the mineral aggregates code, for as many local organizations in marketing areas, as may be necessary.

Hours of labor are to be an average of 40 hours per week during the six months' period March 1 to September 1, or September 1 to March 1, provided no employe shall work more than 48 hours in any week, nor more than 175 hours in any one month, except in emergencies. Rates of pay run from 30c in the South to 45c in the North.

In other respects the code follows along about the same lines as that for the mineral aggregate industries.

H. F. Thomson, president of the National Ready-Mixed Concrete Association, presided. Following is the registration:

Avril Tru-Batch Concrete, Inc., Cincinnati, Ohio—Arthur C. Avril.
Hilltop Builders Supply, Cincinnati, Ohio—Avril Tru-Batch Concrete, Inc.
Richter Concrete Corporation, Cincinnati, Ohio.
Superior Concrete Company, Cincinnati, Ohio.
Ready Mix Concrete Company, Covington, Ky.
National Ready Mixed Concrete Ass'n, Washington, D. C.—V. P. Ahearn, Stanton Walker.
J. K. Davison & Bro., Pittsburgh, Pa.—J. E. Burke.
Keller Bros., Pittsburgh, Pa.—J. K. Davison & Bro.
D. J. Kennedy Company, Pittsburgh, Pa.
Keystone Sand and Supply Company, Pittsburgh, Pa.
McCrady-Rodgers Company, Pittsburgh, Pa.
Marion Coal & Supply Company, Pittsburgh, Pa.
The Ready Mixed Concrete Company, Pittsburgh, Pa.
Vang Ready Mixed Concrete Company, Pittsburgh, Pa.
Central Concrete Mixing Corp., Brooklyn, N. Y.—Audley Clarke.
Transit Mix Concrete Corp., New York, N. Y.—Adam Cramer, Anthony G. Gull.
Gravel Products Corp., Buffalo, N. Y.—Ernest M. Hammond.
Central Concrete Mixing Corp., Brooklyn, N. Y.—A. Johnson.
Federal Concrete Company, Inc., Buffalo, N. Y.—Walter E. Jones.
Maloney Concrete Company, Washington, D. C.—Chas. P. Maloney.
Antonio Concrete Corp., New York, N. Y.—Richard J. Maloney.
Central Concrete Mixing Corp., New York, N. Y.—Maloney & Doyle, Attorneys.
Highbridge Supply Company, Bronx, N. Y.
Charles V. McAtee, Staten Island, N. Y.
J. & I. O'Rourke, Flushing, L. I., N. Y.
Ryan Ready Mix Concrete Corp., New York, N. Y.
Transit Mix Concrete Corp., New York, N. Y.
Boston Concrete Corp., Boston, Mass.—R. S. McSorley.
J. H. McNamara Company, Boston, Mass.—The Whittemore Company.
J. P. O'Connell Company, Boston, Mass.
The Whittemore Company, Boston, Mass.
Automix Concrete, Inc., Brooklyn, N. Y.—Frank H. Morse.
Rock Products, Chicago, Ill.—Nathan C. Rockwood.
Capital Materials Company, Washington, D. C.—H. B. Roberts.
Ryan Ready Mixed Concrete Corp., Brooklyn, N. Y.—Joseph J. Ryan.
Super Concrete Corp., Washington, D. C.—E. S. Simpson.
Ready Mixed Concrete Company, Richmond, Va.—L. G. Thom.
General Materials Company, St. Louis, Mo.—H. F. Thomson.
Williams Transit Mix Concrete, Richmond, Va.—R. K. Williams.

Sand-Lime Brick Production and Shipments in July

THE FOLLOWING DATA are compiled from reports received direct from producers of sand-lime brick located in various parts of the United States and Canada. The accompanying statistics may be regarded as representative of the industry.

Eleven sand-lime brick plants reported for the month of July, this number being one less than the number reporting for the month of June, statistics for which were published July 25:

Average Prices for July

Shipping point	Plant price	Delivered
Grand Rapids, Mich.	....	$12.00
Syracuse, N. Y.	$18.00	20.00
Mishawaka, Ind.	8.50	....
Flint, Mich.	11.50	13.00
Saginaw, Mich.	10.00	....
Dayton, Ohio	9.00	10 00
Philadelphia, Penn.	....	14.00
Toronto, Ont., Canada	12.00	13.50

Statistics for June and July

	†June	*July
Production	730,000	1,147,562
Shipments (rail)	71,000	14,500
Shipments (truck)	1,264,580	946,655
Stocks on hand	1,935,965	2,041,947
Unfilled orders	1,315,000	3,955,000

†Twelve plants reporting; incomplete, five not reporting unfilled orders.
*Eleven plants reporting; incomplete, four not reporting unfilled orders.

Some New Cements—Their Manufacture and Their Special Uses

Lime the Basis of Some Interesting New Products

By Alton J. Blank,
Consulting Chemist, Formerly General Superintendent, Compañia de Cemento Portland "Landa," S. A., Puebla, Mexico

IT HAS LONG been common knowledge that one type of cement is not adaptable to all of the uses to which cement is put, and that sooner or later there must be developed a number of cements for individual uses. However, it is of prime necessity that such a variety of cements be produced in an economical manner and be placed in the hands of the public at as cheap a price as possible.

Thus admittance of the need for new cements has long been felt, and a great deal of extensive and expensive research work has been carried out with the object of developing cements that would be new, not only from the viewpoint of use, but from the viewpoint of manufacture.

To meet the specific demand for quick-hardening cement, there was developed a number of years ago, cements having an alumina base, but the use of these cements was limited to a small field due to their extreme high cost of manufacture and due to certain defects in quality, among which durability was foremost, with the high heat of hardening of cements of this kind also being found objectionable.

From another angle producers of portland cement stepped into the field opened by the demand for quick-hardening or high early-strength cements, with but fair results. To obtain the qualities desired the portland cement chemist found that he must do a number of things, any or all of which were found to add greatly to the cost of manufacture.

The chemist could take his standard portland cement, and by more careful control of the raw materials, finer grinding, harder burning and extreme fine grinding of the clinker, have a product which gave the desired quick-hardening and high early-strength qualities, or he could double or triple burn his materials in the kiln, or do any number of things with his materials and their manufacture, but in each case he found it convenient, if not absolutely necessary, to increase the lime content of his cement, since normal lime content or even low lime content cements, regardless of their treatment or manufacturing procedure, did not give the quality features desired.

It has been definitely established that the high lime content cements, though having initial quality, are not as durable as the low or normal lime content cements. It has also been found that the high-lime content cements have high heats of hardening and are objectionable for certain use. Thus the chemist, to overcome the objectionable features raised with his high-lime content cement, must go back to where he started from, namely, normal lime content cements, and in retracing his steps in this connection he abandons his objective, quick-hardening, high early-strength. Although the cement industry might eventually over-ride the public objection to the high heat of hardening of the new high-lime cements, it is extremely doubtful whether the objection of the same public to lack of durability of concrete manufactured from these same cements could be successfully over-ruled.

Thus, in order to retain all of the desirable qualities present in portland cements, and at the same time omit all of the undesirable qualities, it has been necessary to develop new processes and new cements that are a definite step away from the manufacture of standard portland cements.

Lime the Basis

It has been found that cements adaptable to a great variety of uses may be produced from the raw materials commonly used in the manufacture of portland cement under a process which consists in the hydrating of lime in the presence of siliceous or argillaceous materials and grinding under controlled moisture, temperature and fineness conditions in a simple standard type of apparatus.

Thus, limestone, cement-rock, oyster shells and other materials of calcareous nature of high or low lime content, are calcined and ready for use on the one hand. Siliceous and argillaceous materials such as sands, quartz, diatomite, tripoli, clays, shales, etc., are suitable for use on the other hand; however, those materials not finely divided in their native state may be reduced to the desired fineness before use.

Caustic lime and the siliceous or argillaceous materials are proportioned and sufficient water added to insure hydration of the lime with consequent reaction with the siliceous components of the new mixture, this procedure being accomplished in any ordinary screw-type hydrator or in other suitable installation, from which the mixture is discharged into a tubemill and ground to the desired fineness under controlled moisture, temperature and time limit conditions.

The resulting product may be equal to the highest quality masonry cement, or its quality may approach that of standard portland cement, this depending on the types of material used and the control exercised during the manufacturing process.

It is found that the addition of varying amounts of portland cement clinker to mixtures of the above order previous to the grinding process has a catalytic effect which

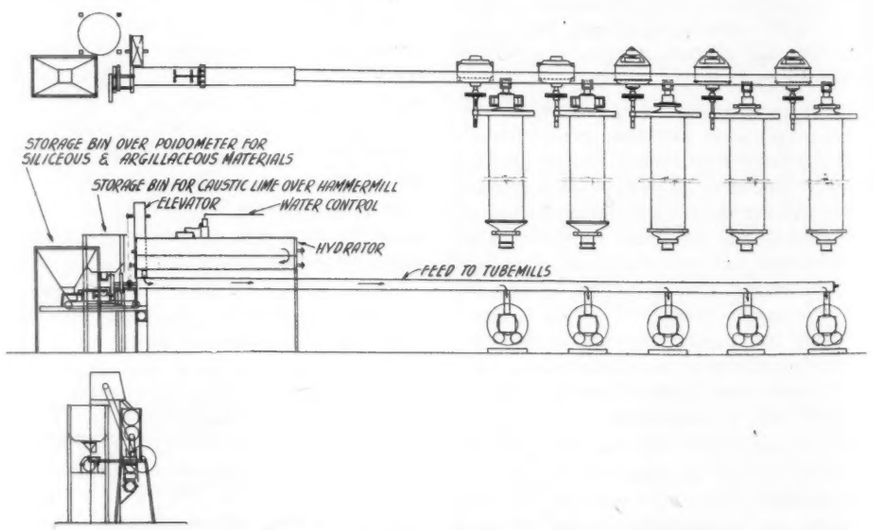
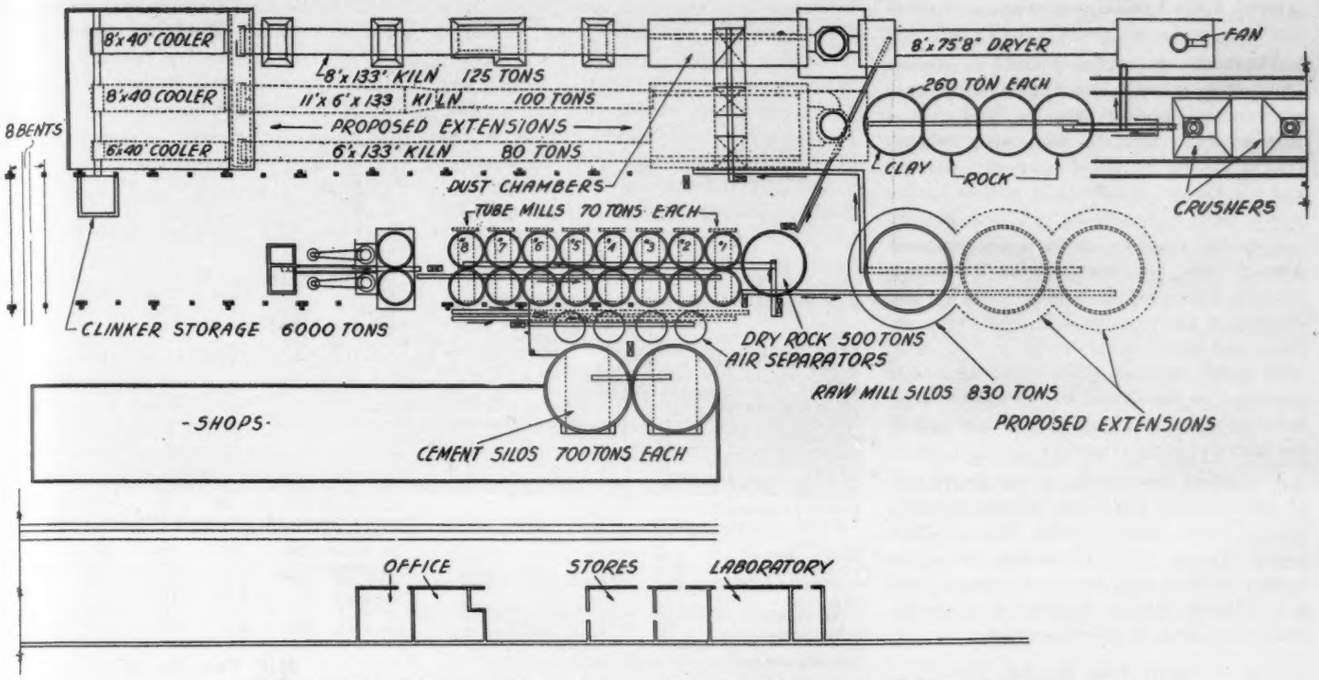


Diagram showing disposition of hydrator and auxiliary equipment used in making new cements at plant of the Landa Portland Cement Co.



Plant layout and proposed extensions of the Landa Portland Cement Co. plant

promotes further reactions or combinations that result in a product which may exceed in quality the so-called "super" cements as now manufactured. Cheaply manufactured cement clinker of low lime content, or softly burnt may be used on an equal footing with higher lime clinker, hard burnt, the resulting quality here as elsewhere of the product resulting depending upon the kinds of materials used and the control exercised during manufacture.

In the case of sands, clays, etc., these materials may be used in their moist state without previous treatment, this also being the case with diatomite, tripoli and like finely divided siliceous materials. Where quartz, sandstone, shale, etc., are used, it is found desirable to reduce them to the desired fineness before use.

New Masonry Cement

In the manufacture of a masonry cement that will be adaptable for use as a brick-laying mortar, as stucco, and as rough and smooth hardwall plaster, it is found that a 75% caustic lime and 25% sand mixture upon being subjected to the ordinary hydration procedure, with approximately 8% of cement clinker added and ground in the mill under moisture conditions that permit of their being not in excess of 10% of combined moisture present in the finished product, and under temperature control that results in the product issuing from the mill ranging from 100 to 140 deg. C., and a fineness in excess of 86% passing 200-mesh, the desired product is attained.

This cement may have a chemical composition identical to that of portland cement, though having a relatively high insoluble residue content. The specific gravity of the product is in the neighborhood of 2.60 and the volume of the product is approximately 50% greater than that of portland cement for a given weight.

A masonry cement thus produced has normal setting properties, good strength, plasticity and great spreading qualities and as a mortar for laying brick, for stucco, or for rough hard-wall plaster, may be used in proportions as high as 1 part cement to 10 parts of sand to give the desired results. The product may be used as a smooth hard-wall plaster by mixing with water to form a paste and then being troweled over the preliminary rough surface, or the dry powdered product may be scattered over the surface and troweled to give equal results.

On the other hand, a masonry cement for exclusive use as a brick-mortar may be made by somewhat reversing the proportions of lime to sand so that a 25% lime and 75% sand mixture is hydrated and ground with a small addition of cement clinker under the outlined control and manufacturing procedure.

Substituting diatomite for sand it is found that sufficient reactions are had with the lime during the hydration and grinding process so as to require no cement clinker to give a high grade masonry cement; however, the proportions of lime to siliceous or argillaceous materials, the amount of water added, the temperature and fineness maintained in the grinding procedure are subjected to variation, as is the amount of cement clinker added as a catalyzer, this depending upon the qualities desired in the finished product.

New Process Portland

The materials and manufacturing control procedure in the manufacture of cements equal in quality to standard portland cements, or the so-called "super" cements, is the same, as in the case of producing masonry cements with the exception that there is usually less lime and more siliceous or argillaceous materials used and a somewhat larger amount of cement clinker to produce the desired catalytic effect.

The manufacture of all products, from masonry to "super" type cement, under the process, permits production of any type or class of cement adaptable or desired for any particular use, meeting any or all specifications of the public, this being accomplished at a low cost of production.

In practice the process may be followed out along lines most convenient to the producer and along with the type of equipment and manner of installation in the individual plant.

In plants having the smaller sized mills it is found convenient to build a small screw-type hydrator to effect hydration of the lime with the siliceous materials previous to the grinding procedure and to obtain, with such an installation, greater control of the different process steps.

In plants having larger mills it is found convenient to effect hydration of the lime with the siliceous materials in the mill during the grinding procedure.

In certain installations it is found convenient to hydrate the lime before use and grind with siliceous materials under controlled moisture, temperature and fineness conditions in the mill. Thus the manufacturer is permitted to use whichever procedure under the process that is most convenient to the types of machinery and its layout in his plant, with an eye towards economy in manufacture, but with the object in mind of producing the highest quality products

possible for individual requirements or specifications.

The kinds of cements possible to produce under the process are numerous, thus a quick-setting cement may be produced, a slow-setting cement, a high early-strength cement having increased later day strength and the desired durability, a cement having a low heat of hardening, a plastic cement, low specific gravity cements with consequent greater bulk per unit weight, bricklaying cements, plastering and stucco cements, and cements in general that will meet every demand and specification of the user, all possible under the same process and with little variation in the kinds and proportions of materials used and the control exercised in the manufacturing procedure.

A detailed description of the production of new cements under the process in question (United States Patent No. 1,912,883, issued June 6, 1933) as carried out at the factory of the Landa Portland Cement Company, Puebla, Mexico, together with considerable test data, is given herewith.

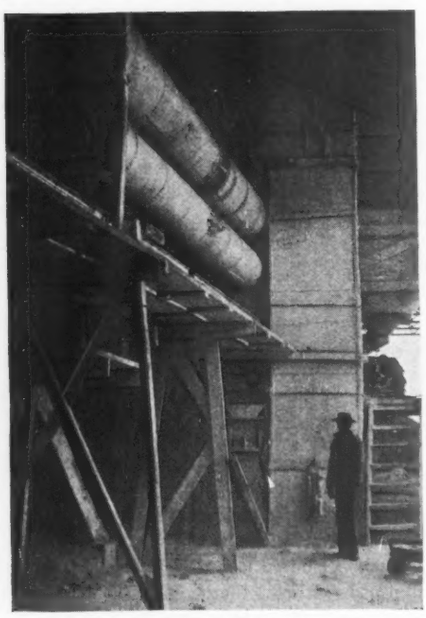
Mill Test No. 86

Caustic lime ranging in size from 2-in. and down as discharged from the rotary kiln, is elevated to a bin situated above a hammer mill.

Lime is fed to the hammer mill automatically and reduced to 4-mesh and down, and is discharged into a common elevator.

Moist river sand without previous treatment is elevated to a bin situated over a poidometer, where it is proportioned and discharged into the common elevator.

The common elevator discharges caustic lime and sand mix into the top section of a screw-type hydrator, at which point a gauged amount of water is added to insure hydration and reactions between the lime and silica, the mixture being conveyed throughout the entire length of the hydrator, which is approximately 125 ft. in length, and discharged into the feed screw of a tube mill. Preliminary ground cement clinker is fed by poidometer to the mill in varying amounts at the later stage of the test, the test consuming approximately 10 hours, during which time moisture, temperature and fineness control is exercised.



Hydrator and complementary equipment with which new cements are made in connection with ordinary grinding units

FINISHED PRODUCTS AS DISCHARGED FROM MILL

Percentage of cement clinker in product	86–A 0.0%	86–B 29.1%	86–C 63.7%	86–D 95.5%
Chemical analyses:				
SiO_2	27.80%	24.00%	22.00%	22.60%
R_2O_3	7.22	7.40	7.80	9.40
CaO	50.72	56.95	60.04	62.83
SO_3	.08	.85	1.71	2.51
Loss on ign.	13.42	10.40	8.44	2.38
Physical tests—				
Norm. Const.	38.3%	32%	31%	27%
Initial set	4:25	1:30	1:10	1:15
Final set	13:35	3:30	3:00	3:00
Specific gravity	2.45	2.59	2.74	3.00
Fineness—				
200–mesh	98.3	98	99	100
325–mesh	....	91	94	97.5
Tensile strength, 1:3 sand, lb. per sq. in.				
Age				
24 hours	32	174	356	401
3 days	37	233	372	452
7 days	54	374	487	598
28 days	268	531	575	625
3 months	408	564	718	672

Mill Test No. 60

Caustic lime in size 2-in. and down and diatomaceous earth in its moist, lump form were fed by poidometer in determined proportions and discharged into the feed screw of a compeb-type mill, at which point sufficient water to insure hydration and reactions between the lime and silica was added. Test consumed approximately 8 hours and at later stage there was fed to the mill along with the above mixture, varying proportions of cement clinker. Moisture, temperature and fineness control exercised during test.

FINISHED PRODUCTS AS DISCHARGED FROM MILL

Percentage of cement clinker in product	60–A 0.0%	60–B 7.0%	60–C 42.0%
Chemical analyses:			
SiO_2	27.24%	26.40%	23.60%
R_2O_3	3.44	4.20	6.40
CaO	50.28	51.16	57.97
SO_3	trace	0.17	1.02
Loss on ign.	17.30	17.25	8.04
Physical tests—			
Norm. const.	55%	53%	36%
Initial set	6:20	4:12	0:15
Final set	15:57	10:26	1:00
Specific gravity	2.25	2.27	2.60
Fineness—			
200–mesh	99.4	99.6	98.5
325–mesh	96.0	97.3	96.5
Tensile strength, 1:3 sand, lb. per sq. in.			
Age			
24 hours	46	61	326
3 days	60	108	376
7 days	111	261	449
28 days	337	475	527

Mill Test No. 78

Caustic lime in size 2-in. and down and tripoli in its moist, lump form were fed by poidometer in determined proportions and discharged into the feed-screw of a compeb-type mill, at which point a gauged amount of water was added to insure hydration and promote the necessary reactions between the lime and silica. Test consumed 10 hours and at middle stage there was fed to the mill along with the above mixture, varying proportions of preliminary ground cement clinker. Moisture, temperature and fineness control exercised throughout test.

FINISHED PRODUCTS AS DISCHARGED FROM MILL

Percentage of cement clinker in product	78–A 0.0%	78–B 17.2%	78–C 46.5%	78–D 62.0%	78–E 90.7%
Chem. analyses—					
SiO_2	33.82%	34.48%	25.40%	21.04%	20.00%
R_2O_3	9.04	8.60	7.44	9.20	8.64
CaO	42.00	44.51	53.37	56.60	60.10
SO_3	0.10	0.41	0.80	1.02	1.57
Loss on ign.	13.70	11.90	11.10	10.00	6.50
Phys. tests—					
N. const.	39%	36%	35%	35%	33%
Initial set	5:15	5:05	1:45	1:46	1:40
Final set	11:15	10:00	9:10	4:00	3:50
Specific gravity	2.28	2.36	2.47	2.66	2.78
Fineness—					
200–mesh	99.5	100	100	100	100
325–mesh	97	97	99	99.5	99
Tensile strength, 1:3 sand, lb. per sq. in.					
Age					
24 hours	28	46	101	231	250
3 days	35	68	167	308	301
7 days	101	158	202	392	366
28 days	295	370	421	449	447
3 mos.	480	502	564	608	616
6 mos.	513	541	595	656	653

Mill Test No. 84

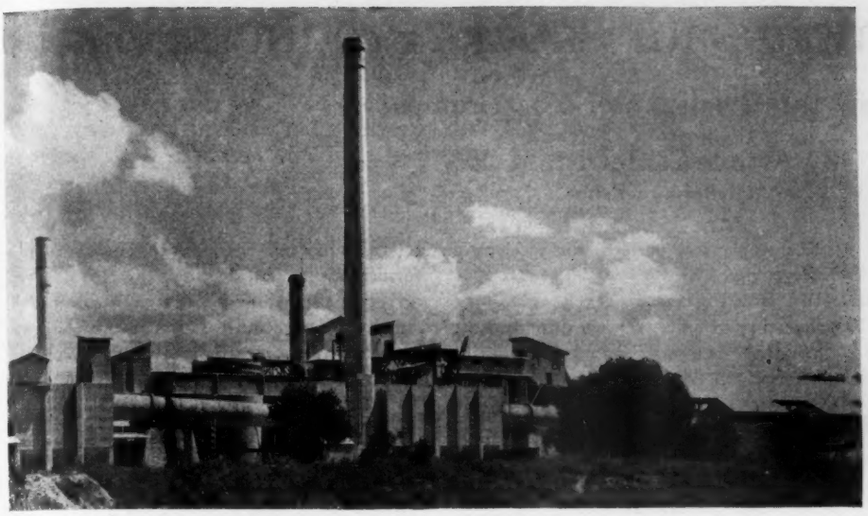
Caustic lime passed through hammer mill and reduced to around 4-mesh, and discharged into common elevator. Quarry clay in its moist, lump form fed from poidometer and discharged into common elevator which discharged into screw-type hydrator, at which point gauged amount of water added to insure hydration and desired reactions. Hydrator in turn discharged into feed end of tube mill and test carried out for 8 hours under controlled moisture, temperature and fineness conditions. Preliminary ground cement clinker fed by poidometer in varying amounts at later stage of test.

FINISHED PRODUCTS AS DISCHARGED FROM MILL

Percentage of cement clinker in product	84–A 0.0%	84–B 42.7%	84–C 55.8%	84–D 76.4%
Chem. analyses:				
SiO_2	18.02%	19.20%	20.60%	23.40%
R_2O_3	8.18	9.00	8.20	9.02
CaO	58.18	60.60	61.90	62.15
SO_3	0.38	1.26	1.54	1.95
Loss on ign.	15.18	8.20	4.90	2.50
Physical tests—				
Normal const.	44%	33%	27%	23%
Initial set	3:05	2:25	1:40	2:00
Final set	11:55	5:38	5:10	4:30
Specific gravity	2.41	2.68	2.74	2.86
Fineness—				
200–mesh	99.5	99	98	98
325–mesh	95.4	93	87	88.1
Tensile strength, 1:3 sand, lb. per sq. in.				
Age				
24 hours	28	204	246	328
3 days	37	381	359	396
7 days	66	361	405	451
28 days	123	507	438	519
3 months	252	553	535	597

Mill Test No. 90

Hydrated lime and tripoli were fed by poidometer to tube mill and gauged amount of water added at feed screw of mill to insure proper reactions between lime and silica. Temperature, moisture and fineness control exercised during test which approximated 10 hours. Cement clinker previously reduced to 4-mesh fed to mill by poidometer along with tripoli and hydrated lime mixture at latter stage of test.



Plant of the Landa Portland Cement Co., Puebla, Mexico

FINISHED PRODUCTS AS DISCHARGED FROM MILL

Percentage of cement clinker in product	90–A 0.0%	90–B 18.0%	90–C 43.6%	90–D 97.7%
Chem. analyses:				
SiO_2	30.72%	25.00%	23.40%	22.00%
R_2O_3	9.52	8.64	9.20	9.40
CaO	41.40	49.70	57.74	62.82
SO_3	1.81	2.20	2.58	3.49
Loss on ign.	15.92	13.00	6.50	2.00
Physical tests—				
Normal const.	34%	30%	28%	25%
Initial set	1:50	1:10	1:10	1:15
Final set	6:30	3:05	3:00	3:00
Specific gravity	2.47	2.62	2.87	2.98
Fineness—				
200-mesh	98.9	100	100	97.8
Tensile strength, 1:3 sand, lb. per sq. in.				
Age				
24 hours	92	279	304	306
3 days	108	297	361	392
7 days	171	359	440	465
28 days	336	504	548	615
3 months	457	562	579	644

Mill Test No. 127

Caustic lime passed through hammer mill and discharged into common elevator. Ordinary field clay in its moist, lump form proportioned by poidometer and discharged into common elevator, and mixture discharged into screw-type hydrator, at which point gauged amount of water added to promote reaction between the lime and silica. Preliminary ground cement clinker fed to mill in constant amount of 50% by weight of above lime and clay mixture. Moisture, temperature and fineness control exercised throughout 8 hours' duration of test. Proportions of lime and clay varied somewhat.

FINISHED PRODUCTS AS DISCHARGED FROM MILL

Percentage of cement clinker in product	127–A 50%	127–B 50%	127–C 50%
Chemical analyses—			
SiO_2	22.46%	24.40%	28.00%
R_2O_3	9.94	10.60	11.20
CaO	62.64	58.01	53.07
MgO	1.05	1.07	1.22
SO_3	1.27	1.41	1.48
Loss on ign.	1.20	4.00	4.10
Insoluble res.	10.90	13.20	18.50
Physical tests—			
Normal const.	26.5%	28%	28%
Initial set	1:15	1:30	1:10
Final set	2:25	3:10	2:40
Specific gravity	2.86	2.93	2.94
Fineness—200-mesh	97.5	98.5	99
Tensile strength, 1:3 sand, lb. per sq. in.			
Age			
24 hours	290	269	167
3 days	354	293	262
7 days	379	364	328
28 days	436	476	463

Mill Test No. 147 (Masonry Cement)

Caustic lime passed through hammer mill and moist sand from poidometer discharged into common elevator which discharged into top section of screw-type hydrator, at which point sufficient water to complete hydration and insure reaction between lime and silica was added. Hydrator discharged into feed screw of tube mill, at which point cement clinker to the extent of 8% by weight of lime and sand mixture was fed constantly to mill. Lime and sand proportions of mixture were varied somewhat during test which consumed 10 hours. Moisture, temperature and fineness control exercised during test.

FINISHED PRODUCTS AS DISCHARGED FROM MILL

Percentage of cement clinker in product	147–A 8%	147–B 8%	147–C 8%
Chemical analyses:			
SiO_2	19.20%	22.00%	24.40%
R_2O_3	9.00	9.40	10.20
CaO	61.88	57.20	53.25
MgO	0.86	0.92	1.08
SO_3	0.57	0.62	0.68
Loss on ign.	8.50	9.60	9.90
Insoluble res.	17.50	24.10	27.30
Physical tests—			
Normal const.	30%	34%	37.5%
Initial set	1:40	2:30	2:45
Final set	3:25	5:00	5:30
Fineness—200-mesh	98	96.5	98
Specific gravity	2.64	2.66	2.69
Tensile strength, 1:3 sand, lb. per sq. in.			
Age			
24 hours	99	87	79
3 days	123	129	108
7 days	189	172	148
28 days	306	309	288

Conclusions

The Landa Portland Cement Co. the early part of June placed on the Mexican market the new cement "Atoyac," which is being marketed in direct competition with its standard portland cement.

The new "Atoyac" cement has somewhat better strength than standard portland cement, the same setting times, somewhat lighter color, lower heat of hardening and somewhat greater bulk per unit of weight.

This cement is a forerunner of a number of cements which will be manufactured for specified uses and is meeting with a marked success in construction which heretofore used portland cement.

The cement has the same chemical composition as standard portland cement, and outside of the definition specification and the insoluble residue stipulation of the present A. S. T. M. specifications for portland cement, passes all specifications by a wide margin.

The second new product that has been placed on the Mexican market is a masonry cement bearing the trade name of "Plastocement" for use as a brick-laying mortar, stucco, and as a rough and smooth hard-wall plaster. This product passes all of the specifications of the A. S. T. M. for masonry cements and is displacing the use of portland cement and portland cement and hydrated lime for masonry purposes.

The advantages of the process from a manufacturing standpoint are manifest over existing methods of producing cements which range from the low-grade, or masonry cement through the portland and surpassing the so-called "super" cements as to quality and number of applications to which the cements can be put.

Existing cement plants, whether of old or new vintage insofar as equipment is concerned, are placed on a more or less equal footing in the manufacturing of cements under the aforementioned process.

Lime manufacturers with little alteration in their equipment are placed in a position where they may produce these cements, thus having a new outlet for surplus lime.

Both industries may operate hand in hand in supplying the public with the various kinds of cements that are desired.

A new field in cement manufacture has been developed and the advantages for the producer and the public are multitudinous.

Sand-Gravel Data

STATISTICS for the sand and gravel industry for 1932 are now available through the United States Bureau of Mines. A summary is given as follows:

Sand sold or used by producers, by uses[2]:	1931	1932[1]	Change, per cent
Glass, short tons	1,677,882	1,330,000	— 21
Molding, short tons	2,138,305	1,100,000	— 49
Building, short tons	25,178,572	11,200,000	— 56
Paving, short tons	27,459,581	17,000,000	— 38
Grinding and polishing, short tons	607,589	400,000	— 34
Engine, short tons	1,604,123	1,300,000	— 19
Fire or furnace, short tons	88,189	52,000	— 41
Filter, short tons	55,319	38,000	— 31
Other,[3] short tons	5,683,266	3,830,000	..
Gravel sold or used by producers, by uses:[2]			
Building, short tons	21,426,814	10,500,000	— 51
Paving, short tons	56,716,230	36,250,000	— 36
Railroad ballast,[4] short tons	10,843,174	6,000,000	— 45

[1]Figures for 1932 are subject to revision.

[2]Figures for 1932 estimated from data available on consuming markets; checked by preliminary reports from producers.

[3]Includes some sand used for railroad ballast, fills, and similar purposes.

[4]Includes some gravel used for fills and other purposes; in 1931, 8,814,907 tons of gravel, valued at $2,898,598, were used exclusively for ballast.

Water Measurements for Rock Products Plants*

Know the Efficiency of Your Pumps!

By Arthur C. Hewitt, M. E.,
Bellefonte, Penna.

IN THESE DAYS it becomes increasingly necessary to scrutinize every operation to see if any item of expense can be reduced. To those plant operators who use power driven pumps I would suggest that all old pumps be thoroughly inspected for wear. Piston pumps as well as centrifugal pumps may become badly worn; and if not properly serviced may have their efficiency drop off to surprisingly low figures. It is not impossible to reach a stage where the power input may be double what it should be under proper conditions.

It is thus possible to spend too much for power to do a certain pumping job. Or in another case a washing plant may have trouble in producing a clean product, and it is quite possible for such a plant to have trouble in holding customers because of poor appearance of their washed stone. A check-up of the amount of water used for washing would then certainly be in order.

The information given in the previous article was intended to call attention to many different methods for measuring the flow of water. With rigid economy ruling every operation, plant men may welcome further data which will meet certain conditions in the least expensive way. To check up on pump performance various types of flow meters, weir boxes, etc., may be used, but frequently such instruments are not available, the cost of obtaining them is prohibitive, or there may not be space available to install certain types of metering devices.

The nozzle or orifice method is well suited for test metering under many conditions at very low cost and with a minimum of disturbance to operation. There are many treatises on hydraulics from which data may be obtained for designing orifices for this purpose, but most plant men do not have access to such publications and the information given in some engineers' handbooks requires a considerable application of mathematics before it can be put to use in the plant.

A commonly accepted formula for orifices or nozzles is as follows:

$$Q = C \times A \times \sqrt{\frac{1}{\left(1 - \frac{d_2}{d_1}\right)^4}} \times \sqrt{2gh}$$

Where
Q is quantity of water in cu. ft. per second,
C is a constant,
A is the area of the orifice or nozzle in sq. ft.,
d_2 is diameter in ft. of the orifice or nozzle,
d_1 is diameter in ft. of the pipe line,
g is 32.2 ft. per sec., per sec., the acceleration of gravity,
h is the effective head in ft.

Converting to units which are more useful to operating men and confining it to thin plate orifices, we have the following formula:

$$\text{G.p.m.} = 29.847\ cd^2\ K\sqrt{P}$$

Where g.p.m. means gallons (U. S.) per minute,
C is the same constant as before.
d is the diam. or orifice in inches.
K is another constant which only changes when the ratio of pipe to orifice changes.
P is gage pressure in lb. per sq. in.

This formula may be still further simplified to the following form which F is a factor which represents all the items in the previous formula between the "equals" sign and the square root of P.

$$\text{G.p.m.} = F \times \sqrt{P}$$

I have calculated the various values for F under many conditions as shown in the Tables I and II for the standard pipe sizes from 2-in. to 12-in. inclusive. The column headings represent the ratio of orifice diameter to the pipe diameter. The use of an orifice larger than 0.8 times the pipe diameter gives questionable results and to use the small orifices requires so much pressure loss through the orifice that the ratios are limited in the tables to 0.4 the pipe diameter.

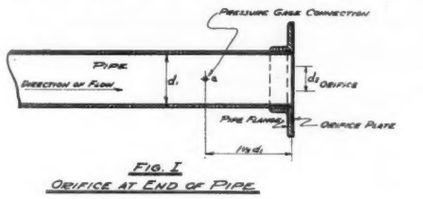


FIG. I
ORIFICE AT END OF PIPE

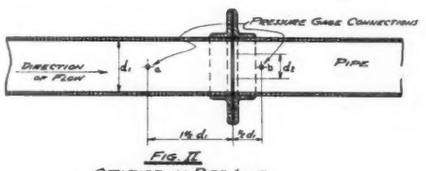


FIG. II
ORIFICE IN PIPE LINE

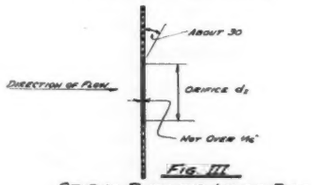


FIG. III
ORIFICE PLATE FOR LARGE PIPE OR LARGE PRESSURE DROP

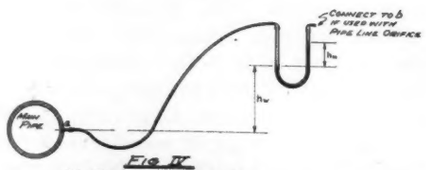


FIG. IV
U-TUBE PRESSURE GAGE
FILLED WITH MERCURY - OR LIQUID OTHER THAN WATER

TABLE I—END ORIFICE

Table gives value of F in the formula

$$\text{g p.m.} = F\sqrt{P}$$

Orifice = Fraction of pipe diam.	0.8	0.7	0.6	0.5	0.4
Pipe size					
12 -in.....	2272	1522	1037	688	425
10 -in.....	1578	1057	720	478	295
8 -in.....	1010	676	460	306	189
6 -in.....	568	381	259	172	106
5 -in.....	395	264	180	119	73.8
4 -in.....	252	169	115	76.5	47.2
3 -in.....	142	95.1	64.8	43.0	26.6
2½-in.....	98.6	66.0	45.0	29.9	18.4
2 -in.....	63.1	42.3	28.8	19.1	11.8

TABLE II—ORIFICE IN PIPE LINE

Pipe size	0.8	0.7	0.6	0.5	0.4
12 -in.....	2301	1476	1009	674	422
10 -in.....	1598	1025	700	468	293
8 -in.....	1023	656	448	299	188
6 -in.....	575	369	252	177	106
5 -in.....	399	256	175	117	73.3
4 -in.....	256	164	112	74.9	46.9
3 -in.....	144	92.2	63.0	42.1	26.4
2½-in.....	99.9	64.1	43.8	29.2	18.3
2 -in.....	63.9	41.0	28.0	18.7	11.7

Construction of Orifice

An orifice plate should be of thin steel or any metal which will not erode appreciably during its period of use. The thickness should preferably be about 1/16 in. at the orifice, and if greater thickness is needed in the larger sizes, due to a large pressure drop at the orifice, the bore should be as shown in Fig. III.

For great accuracy the pressure gage connections should be a series of truly radial openings all piped together so as to get a true average pressure. For ordinary accuracy a single ⅛-in. pipe connection will suffice. These pressure gage connections must be about the distances away from the orifice plate as shown in Figs. I and II. This is important.

An ordinary pressure gage of the Bourdon tube type, if really accurate, may be used. But for accuracy and especially for all low pressures a U-tube type of gage is much better. Such a U-tube may be filled with water, oil or mercury. For end orifice use at low pressures it is possible to simply use a rubber hose connected to the gage connection, and by measuring from the center of the main pipe to the top surface of the water in the rubber hose the hydraulic head or pressure drop is found in feet or inches of water.

*See also article under same title which appeared in "Rock Products," June 8, 1929.

This measurement is taken when the top end of the hose is held just far enough above the pipe so that the pressure of water in the pipe is just balanced by the head in the hose. The ratio of head of water to the pressure in pounds is:

1 ft. = 0.433 lb.
or 1 in. = 0.036 lb.

When oil or mercury is used, the specific gravity of that fluid compared to water must be known and the corresponding correction made.

When an orifice is used there should be a straight length of pipe on the up-stream side at least equal to 10 times the pipe diameter. Twenty or more pipe diameters of straight pipe is preferable. When an orifice plate is used in a pipe line such as shown in Fig. II, the straight length of pipe on the down-stream side should be at least 5 diameters, preferably 10 or more. Straight runs are necessary to prevent eddy currents giving erroneous pressure readings.

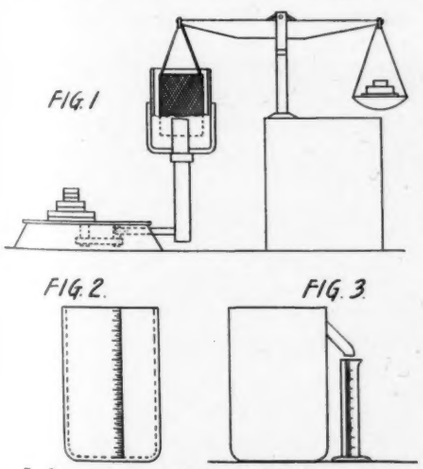
Pressure gage connections must be smooth and without burrs or projections inside of the main pipe, and must be perpendicular to the flow of water.

Caution

The orifice method is satisfactory only on fairly clean water or other fluids which are free from solids which might settle out and build up behind the orifice plate causing pressure gage readings which are uncertain.

Properly constructed orifices with pressure gage connections in correct positions so that correct pressures are read should give an accuracy within about 3% of calculated values of flow.

As stated previously a home-made orifice meter is not recommended for permanent use, in which case a factory made orifice plate with its proper recording instrument should be installed. But where a quick and low cost method of measuring the flow of water in a pipe is desired this method may be very useful. There are many reputable firms in this country who now manufacture orifice meters which are said to give even better accuracy than the above mentioned figure.



Laboratory apparatus demonstrating principles of device for batching aggregates

Aid for Ready-Mixed Concrete Plant

Device for Determining Retained Water in Aggregates

By Walter B. Lenhart

GRAHAM BROS., INC., Long Beach, Calif., sand, gravel, crushed stone and ready-mixed concrete producers, have developed a new weighing device by means of which the absolute volume of aggregates can be determined; that is, the weight of material disregarding those voids that are entirely enclosed within the mass and which, consequently, do not affect a concrete mixture.

The device provides a novel means for determining the absolute volume or weights of aggregates by means of an arrangement whereby the aggregates are weighed submerged in water, simultaneously weighing the liquid and its container holding the aggregates in air. The ultimate object sought in the apparatus is to provide means of determining the absolute volume of the aggregates, to keep the water volume constant and to provide a method of determining the absolute weights of aggregates when the specific gravities are known.

The apparatus as installed at Graham Bros., Inc., plant eliminates former difficulties in mixing concrete in that all factors remain constant, namely, variations in the voids are compensated for and also the contained moisture. Under usual practice the method of caring for this moisture content is to make prior tests for moisture on the aggregates and then apply these data to the mix. This does not always represent the true condition encountered in practice and results in non-uniform concrete. In this new device the entire aggregate used is reduced to its absolute volume, or weight, so that the above weaknesses in the older practices are automatically overcome.

In Fig. 1, a side elevation shows how the new device functions. Fig. 2 is a side elevation of a liquid container calibrated to indicate increased volume. Fig. 3 is a side elevation of a liquid container arranged to catch the overflow as the volume therein increases.

The process consists in first weighing the aggregate in air, then weighing the aggregates submerged in water; also weighing the water in which the aggregate is submerged, both before and after submergence. It is evident under such a procedure that the contained moisture ceases to be a factor and the absolute weight or volume of the aggregate is ascertained.

Paul Graham, president of the company and inventor of the device, found that the increased weight of the water in which the aggregate is submerged is equal to the increased volume created; i. e., the volume added becomes water weight plus any and all moisture contained in the loose voids of the material.

As shown in Fig. 2, the container may be calibrated to indicate the rise in water level when the basket and its contained aggregate are placed within.

In Fig. 3 is shown a liquid container which is provided with an over-flow pipe which discharges into a graduate. With this latter arrangement, the increased volume placed in the container can be accurately determined. It is important that the basket shall not rest on the bottom of the container, but at all times be suspended therein.

After the aggregates have been weighed, water is withdrawn from the container, leaving only a sufficient quantity to provide a concrete of a given slump, and this is the water used in the mix.

The water content of the aggregate is computed by the difference in the weight of the water in which the aggregate is submerged, over what it should be when calculated from its specific gravity.

As demonstrated in a laboratory test a sample of sand was taken, the weight of which in air equalled 1060 grams. Submerged in water, the sand weighed 666 grams: 1060 minus 666 leaves 394 grams loss, or 394 c. c. of water (1 c. c. of water weighs 1 gram). On the platform scales shown, the original weight of the water was 360 grams: the final weight of the water with the sand submerged but suspended therein was 820 grams: 820 minus 360 gives a difference of 460 grams, which is the weight added to the water by the equivalent volume of sand and its contained water 460 grams minus 394—the difference previously obtained, leaves 66 grams, which is the water content in the sand. Obviously, if the specific gravity of the aggregate is known, the step of weighing the aggregate in air prior to its submergence in the water can be omitted.

While all the above discussion may appear involved, in fact they are, but the actual device as built and installed at Graham Bros., Inc., is so arranged that any intelligent laborer can make the apparatus function properly. It requires roughly 3½ minutes per 3-cu. yd. batch of material to make a complete cycle and the results obtained are said to be satisfactory and make it possible to secure uniform slumps in the resulting concrete.

The device is mounted under one of the main storage bins so that the weighed aggregates can be discharged to one of the company's Transit mixer trucks.

Concentrating table showing feed box and launder

Removing Foreign Materials From Sand and Gravel By Use of Concentrating Tables

By Frances Sinclair

THE firm of T. L. Herbert & Sons, Nashville, Tenn., has been a producer of sand and gravel for the past 23 years. During all these years, the problem of ridding Cumberland River sand and gravel of foreign matter has been an engaging one.

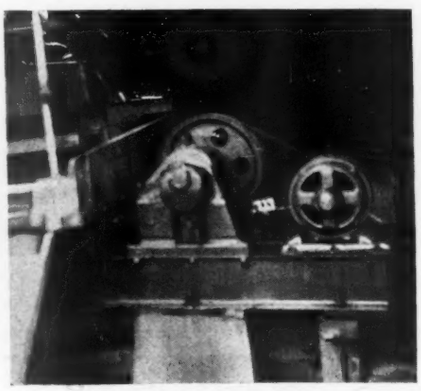
Relics of an age when this was the hunting ground of Creek and Cherokee warriors; hilts of swords, shells and minnie balls, mute testimony of the battleground of the "Lost Cause" and the part the waterways played in that great struggle nearly seventy years ago, all are brought up by the dredges. Interesting as all these articles are to the archeologist and the historian, they haven't a commercial value to the contractor who is awaiting delivery of sand on his job—sand that must measure up to specifications.

So the story is a long one, too long to tell, of trial screens, classifiers, jigs, etc., etc., for cleaning the sand and gravel; but, as so often has happened in the history of this company, it left the beaten track and determined to use a method that had not been tried before in the production of commercial sand. The gravity principle, which had long been in use in collieries and mining plants for the separation of their products and the recovery of certain valuable ores, seemed the logical answer to the sand and gravel cleaning problem of this firm. The problem was exactly the same. Mica was being recovered from kaolin, slate removed from anthracite, copper, brass, tungsten, and zinc from various waste materials. Why not apply the same principle to the cleaning of sand and gravel?

Accordingly, last January an order was placed with the Deister Concentrator Co., Fort Wayne, Ind., for two specially built concentrating tables. The tables are now in operation, producing a satisfactory tonnage of the highest grade of concrete sand. The preparation of commercial sand for the market is more correctly a manufacturing process than a simple dredging and screening operation, for the standards that are to be met for high grade sand require not simply a process or two but at least five operations and special equipment for each process.

Flow Sheet

We will run very briefly through the handling of sand and gravel by this company from the time it is dredged to the perfectly cleaned sand that will meet the most exacting specifications. The handling of gravel will not be touched upon in this article as this trial is to be made later. Sand and gravel are dredged from the river by a Worthington Diesel-motored electric clam-shell dredge. The first separation is on the dredge when the sand is washed and screened from the gravel, masonry sand being separated at this time from the concrete sand, and each grade is loaded into separate barges as is also the gravel. These barges of sand and of gravel are towed to the plant and a clam-shell bucket, operated by a stiff-leg derrick unloads them at the city plant. The sand is then carried by belt conveyor to the hopper located just above the concentrating tables.



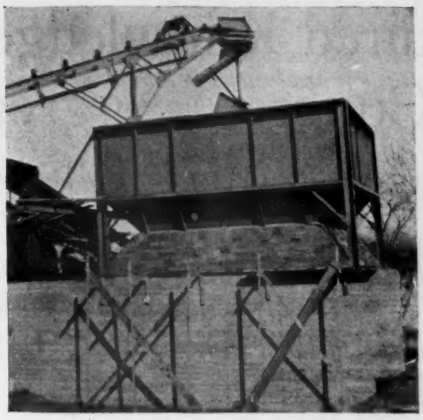
Drive operating the concentrating table

The entire plan and lay-out of the concentrating plant is of T. L. Herbert & Sons' own design. All steel superstructure and hoppers were furnished by the Nashville Bridge Co. The conveyors and dewatering drag are of T. L. Herbert & Sons' construction, using Link-Belt equipment.

The accompanying illustrations show the 300-ton hopper of the concentrating plant with the partition which divides it into two compartments. Below each of these compartments is the concentrating table on to which the sand is fed. The bottom of each of these compartments or bins opens into an inundator which is filled with water. The valve through which the sand and water is fed to the table is of unusual design and is

also of T. L. Herbert & Sons' construction. As stated above, these tables make their separations based on a difference in the specific gravity between the recovered product and the waste material. In this case, the recovered material is the larger percentage and the waste material a very small percentage. The operation is a wet process, water forming the flotative agency for stratifying the different materials and carrying the lighter gravity particles into the refuse. The sand is flushed into the table feed box with water and dressing water is added along the edge of the deck to assist in washing the lighter material across the table. The dressing water launders along the edge of the table are equipped with adjustable buttons, having a single screw in each. By the simple turning of this screw the most exacting regulation of water supply may be secured. Riffles applied crosswise to the direction of the wash water travel and parallel to the line of the motion of the table assist in directing the heavier material to the product take-off points. The mechanical motion of the table not only contributes to the stratification of material on the table deck but produces the means of advancing the heavier particles in a direction approximately at right angles to the washing.

These tables are of the Deister-Overstrom diagonal-deck type and are the largest size tables built by the Deister Concentrator Co. The treating decks of these tables are 7 ft. 10 in. wide and approximately 17 ft. long. Each deck is divided into two distinct treating areas with separate feed box, wash-water launders, riffling system, refuse disposal section and product discharge. For both treating areas the refuse is discharged along a common apron on the side opposite the feed boxes and wash-water launders. The product from the first treating area is discharged at a point midway in the length of the table through openings in the deck. These openings are rectangular in shape and are a special feature of the Herbert & Sons' tables. Through these openings the washed sand is discharged into rubber boots extending down through the underconstruction of the table to the launder. These rectangular openings



Three-hundred-ton hopper of concentrating plant of T. L. Herbert and Sons

practically make two tables out of one and this original feature has given good results. From the launder or chute beneath the table, the cleaned sand passes into the dewatering drag which discharges to the Link-Belt conveyor by which the cleaned and dewatered sand is carried to the hopper at the top of the incline. The product from the second treating area discharges from the apron at the end of the table into a suitable launder or chute where it joins the cleaned sand from the first treating area. The water and refuse from the launder is discharged by flume into the river.

Rubber Used for Abrasive Resistance

The decks of these tables are built of all cypress lumber, rigidly framed and reinforced. The decks are covered with a high-grade one-piece rubber cover and riffled with special moulded riffles. The discharge openings in these decks are carefully finished off and walled with rubber so as to insure against any leakage of water through the deck. In the past concentrating tables were covered with linoleum and riffled with either soft or hard wood. But the moulded rubber cover and moulded rubber riffles which have been developed specially for these tables are far more durable, sometimes lasting ten times as long at a great saving in the expense of recovering and reriffling at frequent intervals.

The decks are supported and reciprocated on a specially constructed steel subframe which is also adjustable for side tilt. This subframe in turn is supported by a main channel base capable of end inclination adjustment. The main channel base also supports the table head motion which forms the means of reciprocating the deck. The latest type of short center V-belt drive by individual motor operates each table. But little power is required to operate these tables. Two and one-half horse power is usually the maximum requirement. The Overstrom head motion is used with these tables. It is self-oiling and dust proof and of utmost simplicity as it contains few parts and only one adjustment which can be made while the table is in operation. It admits of variation in stroke from 5/16 to 1⅜ in. The Herbert & Sons' table has a stroke of 15/16 in. and is reciprocated at 295 strokes per minute.

These tables are now giving a tonnage of 18 tons each per hour. The standard strength ratio obtained on this prewashed sand averages about 25% above the specification required by the State Highway Department. Formerly Cumberland River sand, to meet these specifications, required to be dug from virgin bars. The colormetric test uniformly shows No. 2 plate, while the unprocessed sand often gives No. 5 plate.

One of the great advantages of the use of a table lies in the fact that the process of separation is always visible to the eye and necessary changes may be made without interrupting the operation. Since the water supply, the slope of the table, and the outflow of the material is always in sight of the operator, he has full control over the operation. Only one man is needed to operate the tables.

The plant has a most convenient location in its nearness to the recently built "Continuous Mix" concrete plant; and, as most of the product of the plant will be used in various types of highway construction and maintenance, its situation within a few feet of the railroad tracks makes easy loading to railroad cars. It is equally accessible to truck loading from storage bin or stock pile.

Left: ***Hopper for finished product at plant of T. L. Herbert and Sons, Nashville, Tenn. Right: General view of south end of sand plant, showing concentrator plant and concrete plant***

Newly Acquired Knowledge of Cement and Concrete Aggregates

Producers Must Keep Posted to Satisfy Demand for Quality Products

By F. O. Anderegg, Ph. D.,
Consulting Specialist on Building Materials

DURING the past twelve months some interesting developments have taken place in the theory of portland cement and concrete aggregates, and in the application of theory to practical purposes.

In addition, a better understanding is being had of the necessity of a more thoroughgoing, fundamental analytical study of the properties needed in a cement for different applications. For instance, if it is desired to build a reinforced-concrete arch for a bridge, what combination of early and later period compressive, flexural and tensile strengths; creepage under load; weather resistance; initial shrinkage; volume change under varying temperature and moisture conditions; heat development during hydration; workability and water requirements in the cement, will make the best bridge? How shall the cement be designed to give the ideal combination? What kind and grading of aggregate shall be chosen and how shall the concrete be cured?

The same questions can be asked about materials for concrete roads, for mass concrete, for water reservoirs and canals, for precast building units, for masonry when built of low absorption or of high absorption units, or when reinforced. For many special purposes other particular properties must be carefully considered, such as corrosion of lead for cable conduits; resistance to heat for construction around furnaces; and in food products plants and dairies because of the corrosive action of lactic, acetic and other acids and of sugars, special building materials are required.

Clinker Grinding

In order to obtain from a given clinker its best service it is necessary to give it proper grinding. In grinding, the important thing is to provide surface for contact with the hydrating water, and yet a proper balance must be maintained among the different sizes so that a well compacted paste of low water requirement and reasonably good workability is produced. This requires knowledge as to the effect of the size, speed and loading of the grinding machine and of the size of the grinding medium upon the size distribution of the cement. A cement can be ground beyond the optimum point, according to Davies-Graham [Rock Products, 1933, No. 1, p. 24], but a vast amount of experience including that of Rordam [Rock Products, 1932, No. 15, p. 22] has shown that the finest sizes, below ten microns, are necessary for the proper behaviour of the cement. The analyses of Carlson and Bates [Rock Products, 1932, No. 21, p. 18] showing a greater amount of tricalcium silicate in the finest fraction is of interest.

Size Analysis of Cement

The problem of the size distribution of cement is one that is attracting increasing attention with the general improvement in cement quality and especially with high early strength cement. The old Pearson elutriator still gives very reliable results, but it is extremely laborious in its operation. It is true that Roller[2], and later Miyazawa [Rock Products, 1933, No. 3, p. 45] have suggested some improvements, but the action is still slow. To secure a greater speed a sedimentation apparatus has been described by Reed-Lewis[3] who uses Butanol as a suspending medium. Considerable overlapping of sizes is apt to occur in this apparatus, making it at times difficult to interpret the results.

The most recent contribution is Wagner's turbidimeter [Rock Products, 1933, No. 7, p. 43] which permits an estimate to be made of the total surface of the cement within a few minutes and also gives some idea as to the size distribution.

Setting of Cement

Paul Schachtschabel has given much thought to the problem of inversion of a finely ground cement, fairly high in alkali, into a flash setter on exposure to the weather [Rock Products, 1932, No. 24, p. 40; 1933, No. 1, p. 38]. Alkalies, hydrolyzed and carbonated by exposure, are supposed to react with the gypsum changed into a very soluble form by the heat present during grinding and storage, leaving the latter in a form where its retarding effect is seriously diminished.

M. H. Whitworth, however, believes the effect to be caused by the rapid solution of the hemihydrate and crystallization as gypsum [Rock Products, 1933, No. 6, p. 43].

Dorsch connects the setting time, the heat of hydration and the electrical conductivity of cement finding some interesting relationships [Rock Products, 1933, No. 6, p. 42]. Baire proposes that the electrical conductivity gives a more satisfactory idea of the setting of cement than does the Vicat needle [Rock Products, 1933, No. 1, p. 38]; while Kleinlogel and Hajnai-Konyi feel that the rate of heat evolution gives the best idea of setting behaviour [Rock Products, 1933, No. 3, p. 45].

Heat of Hydration

Recent attention has been focused on the heat developed during the hydration and upon the rate at which the heat is evolved, as controlled by the chemical compounds found in the cement and by the surface exposed. The occasion for this attention arose from the design of the great Boulder Dam which calls for large blocks cast in place, that must then be grouted together after the bulk of the heat has been removed. For this purpose a cement was designed having a low final heat of hydration.

Much of the preliminary work was done in the laboratory of the Riverside Cement Co. and the calorimetric method developed for the determination of the heat of hydration of the different compounds found in portland cement, as worked out by Woods, Steinour and Starke[4] has been a great aid in increasing our knowledge about this property. The heat developed becomes increasingly important in mass concrete, and at higher temperatures, partly because of strains developed by volume changes, and partly because of the effect on the properties of the cementing gel. Under such conditions, specifications controlling the total amount of heat developed on complete hydration as well as the rate of heat evolution would seem to be logical and reasonable. On the other hand, for low temperature work, specifications might well be in order for a cement with a minimum rate of heat evolution. Here it is important for the production of a satisfactory increase in strength within a reasonable time. This consideration leads logically to the next topic.

High Early Strength

The economic advantage of being able to complete a job in a short period of time would seem to justify very often the use of a cement which will acquire considerable strength rather quickly. Again it may appear more economical when designing for strength alone to use a mix containing 4½ bags of higher strength cement than six of standard cement, especially where freight charges mount up.

Two types of cements are available to

secure high strengths, aluminous cements and high-lime portlands. In spite of their higher costs, aluminous cements have found a useful service because of their resistance to many corrosive solutions and to elevated temperatures, and for other special purposes. Much remains to be worked out to secure a better understanding of their setting and hardening reactions and to develop new uses. The increase in lime content in portland cement seems to have started soon after Aspdin's discovery over a hundred years ago and it has been gradually increasing ever since. The writer has talked with cement men in Austria, Switzerland, Germany and England who firmly believe they were the first to raise the lime content of cement, but since Rankin published his diagnosis that the important constituent in portland cement is tricalcium silicate, based on the classical studies carried out at the Geophysical laboratory, the rest has been a mere matter of detail.

By increasing the lime content, greater care is necessary in grinding and blending the raw mix, in burning the cement and in the final grinding. The concrete making properties are appreciably affected, in that the strength is attained much sooner and more heat is evolved, so that proper allowance must be made for the temperature of the application. If the concrete gets so hot that the gel becomes rapidly indurated, strains are set up and a brittleness is obtained resulting in an unfavorable comparison with standard cements at longer periods than the first few weeks. If the temperature is controlled, so that the gel has a proper chance to ripen, a continued greater strength than that reached with standard portlands is to be confidently expected.

The upper lime limit for portland cement has been receiving a great deal of attention during the past years. Reference might be made to a series of contributions by Louis Dahl [Rock Products, 1932, Nos. 12, 14, 16, 18, 20, 22; 1933, Nos. 2, 3, 4, 5]. Also Prof. Kuehl's laboratory in Germany has turned out quite a number of articles on this subject[5]. The combining power of the silica, alumina and iron oxide are the chief controlling factors, as modified by the uniformity and intimacy of the raw mix and by the size of the particles.

Many people profess to be alarmed by the larger quantity of soluble lime set free during the hydration of high-lime portland cement[6], and yet others have brought to our attention data indicating an actual improvement in strength and impermeability resulting from the addition of the 5% to 10% lime to portland cement[7]. Another important angle is the opportunity, which solvent or agressive solutions may have, to come in contact with the lime. It is a fact that most high early strength cements are carefully ground, producing an easily working paste having smaller moisture content relative to the surface area than most standard portlands. What harm would it be to a concrete if the lime set free from portland cement be increased from, say, 15% to 20%, when the rate at which the moisture passes in and out of the concrete is correspondingly reduced? Provided, of course, that the extra lime does not appreciably increase the strains in concrete caused by expanding calcium hydroxide crystals.

In view of these considerations, no engineer, who has any respect for concrete durability, where moisture comes in contact with the concrete, would reduce the cement content just to pass a minimum strength specification.

Curing of Concrete

When the surface of the cement particles is wetted, the hydration reaction starts and a glue-like material is formed, which undergoes certain progressive changes characteristic of colloidal gels. It gradually squeezes out some of the excess moisture and stiffens or sets to a hard, horny mass. The manner in which this sets will determine to a considerable extent the service given by the concrete. We know that the setting reactions are very slow in cold weather, but they may be all the better in the long run for such a period of ripening. On the other hand, as the temperature rises these indurating effects are greatly speeded up and advantage is taken of this fact in curing concrete products with a warmish spray at about 125 deg. F. If the temperature rises much above this, we have reason to suspect that the gel gets too hard and brittle. If, however, the temperature is raised quite high, an entirely different reaction predominates, a combination between the lime from the cement and any siliceous material in the aggregates[8]. The lime silicate so formed seems to be quite permanent and resistant to corrosive agencies. But the question arises as to whether this is the best method of bringing about such a reaction. Two recent developments involve lime as the starting point, include Rostone [Rock Products, 1933, No. 5, pp. 44-46], and a new lightweight unit of surprising lightness for its strength, called Microporite, which has not yet been described in a technical publication.

Corrosion Resistance

The outstanding contribution on this important problem has been by Dr. Karl Dorsch of Karlsruhe who has given us a more far-reaching analysis than anyone else. His work is appearing currently in *Cement and Cement Manufacture* and is being reviewed in Rock Products.

Volume Change

Those changes in the volume of concrete caused by variation in moisture content and in temperature seem to manifest themselves most obviously in concrete roads. To reduce this deleterious effect it has been proposed in Germany[9] to grind in a small amount of bituminous material with portland or with a mixture of portland and natural cements. This slows down the setting of the cement and improves its workability so as to make it suitable for the Hassam type pavement or cement grout penetration macadam. So much compacting is given with heavy rollers that it is practical to drive over the road as soon as finished. It is claimed that the presence of the bitumen reduces the effect of variable temperature and moisture on the volume of the concrete.

Masonry Cements

The success of the earlier special masonry cements has been such that more than forty are now being offered for sale. Some are being produced by the portland cement manufacturers where the portland cement content receives emphasis, others by lime producers and here the lime content is kept rather high. The composition ranges all the way from feebly hydraulic limes, through natural cement and slag to those high in portland cement. The plasticizing agent may be hydrated lime, finely ground clay or shale, or other admixtures, at times. The needed elasticity is obtained by hydrated lime, by finely ground limestone or by natural cement. Unless a clay is carefully chosen, efflorescence may follow due to base exchange. The past year has seen a marked increase in the number of masonry cements waterproofed.

Pozzuolans

The reaction involving the addition of some sort of silicate, which is supposed to be reactive toward lime, to portland cement is constantly demanding attention and a series of papers has appeared including that by Hughes and Levens [Rock Products, 1933, No. 1, p. 31]; Feret (Rock Products, 1933, No. 5, p. 40], and Carlson and Troxdell [Rock Products, 1933, No. 7, p. 43]. The effectiveness of the use of these admixtures depends so much upon the temperature that their beneficial action is best obtained in the hotter climates. The Romans discovered this and we are still rehashing their experience.

Concrete Aggregates

An interesting and suggestive article by Weymouth [Rock Products, 1933, No. 1, pp. 26-31] showed how the presence of an excess of any one size, by slipping in between the coarser aggregate, interfered with the packing of the latter, and hence had a deleterious effect on the concrete. He pointed out also that in the drier consistencies the smaller aggregate particles may become coated with cement so that that cement may do, not only little good, but an actual harm by interfering with the packing of the other aggregate.

That the flexibility of the aggregate itself needs to be considered in connection with those volume changes, chiefly brought about by variations in moisture content, and with reference to strains set up in the concrete structure, has been pointed out by Graf [Rock Products, 1933, No. 6, p. 42]. For instance, limestone, by virtue of its structure, is capable of yielding to strains much more

readily than most igneous rock. As a cement hardens and dries out it exerts tremendous shrinkage force. When the aggregate is rigid it opposes the pull and more strain is set up within the cement than with a more yielding aggregate. Is this desirable or undesirable? A fascinating problem for someone to work out for the different applications of concrete.

Vibration

During a symposium at the meeting of the American Concrete Institute in February considerable attention was given to this method of placing concrete. Very fine results were reported by Davis and Davis[10], Powers[11], Clair[12], and Reagel[13]. Jackson and Kellerman have also reported on their work at the Bureau of Public Roads [Rock Products, 1933, No. 7, p. 43]. With the aid of vibration properly applied a marked improvement in the packing of aggregates has been repeatedly obtained. The practical result has been that a coarser, harsher aggregate in a drier, leaner mix can be placed to produce a dense concrete. If the grading of the aggregate is such that it can be packed into a small space, then the fact that it is hard to place is overcome by effective vibration.

References Cited

[1]Bates, P. H. American Society for Testing Materials (1933) *Preprint.*
[2]Roller, P. S. American Society for Testing Materials *Proceedings* (1932) **32**, II, p. 607.
[3]Reed-Lewis, E. W. *Concrete* (1933) **41**, No. 2, p. 14.
[4]Woods, Steinour and Starke. *Industrial and Engineering Chemistry* (1932) **24**, No. 11, p. 1207. Davis, Carlson, Troxell and Kelley. *Journal of the American Concrete Institute* (1933) **4**, No. 9, p. 413.
[5]Several have been reviewed in Rock Products (1932) **35** and (1933) **36**; Hess, No. 13, p. 54; Spohn, No. 3, p. 44; Solacodu, No. 4, p. 40; Kuehl, No. 5, p. 40.
[6]Paul, Ira. *Engineering News Record,* (1933) **11**, p. 212.
[7]Johnson's Materials of Construction, 7th Ed., p. 491.
[8]Thorvaldson, T. *Journal of the American Concrete Institute* (1933) **4**, No. 2, p. 102.
[9]*Concrete* (1932) **40**, No. 10.
[10]Davis and Davis. *Journal of the American Concrete Institute* (1933) **4**, No. 9, p. 365.
[11]Powers, T. C. *Ibid* (1933) **4**, No. 9, p. 373.
[12]Clair, Miles N. *Ibid* (1933) **4**, No. 9, p. 383.
[13]Reagel, F. V. *Ibid* (1933) **4**, No. 9, p. 391.

Cutting Maintenance Costs in Rock Products Plants by Welding

By J. S. Roscoe

District Manager, The Lincoln Electric Co., Cleveland, Ohio

THE VERY NATURE of the machinery used in rock products plants and the service to which it is subjected make welding almost indispensable. The savings effected by comparing the cost of welded repairs with the cost of replacement frequently are sufficient to pay for the cost of a welding machine in the space of three or four weeks.

The purpose of this article is to show the many uses to which arc welding is being put in crushed stone plants today. It is in effect a check list of money-saving repairs which can be made by welding together with a detailed explanation of some of the more unusual jobs.

For practically all repairs to mild steel parts, coated electrodes are recommended in preference to bare or washed electrodes. This is because the shielded arc process utilizing coated electrodes provides welds having far greater strength and increases the welding speed from 100 per cent to 300 per cent. This means not only better welds, but lower repair costs and less time lost while the parts being repaired are out of service.

Water Lines

Welding plays an important part in the maintenance of water lines. It is used for repairing broken joints, leaks, and in making new connections to existing water lines. This is a common job and a very simple one. In the case of large leaks it is necessary only to cut a hole in the existing line and weld in a new sleeve. Small pinhole leaks are frequently repaired by welding a patch on the line. Size of electrode for use in pipe line welding depends on the thickness of the pipe. For smaller sizes 5/32-in. coated electrodes are usually used; for larger sizes, 3/16-in.

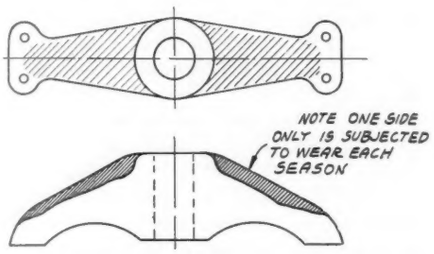


Fig. 1. Method of building up gyratory crusher spider and hard surfacing with a high manganese steel electrode

By welding connections on pipe lines, all screw fittings, couplings, tees, etc., are eliminated.

Locomotives

Repairs to locomotives are frequent, and many times it is exceedingly important that they be put back into service immediately. Frame breaks may be repaired by the shielded arc process with no question as to the strength of the weld.

Welding flues is a common repair job. For this purpose 5/32-in. or 3/16-in. coated electrodes are used and welds made from the top of the tube down each side. Adjacent flues should not be welded consecutively, as this will localize heat in one section of the flue sheet.

Side sheets and flue sheets frequently rust and become weakened, necessitating their replacement if they are not welded. They may be built up by placing layer after layer of welded metal on the thin plate until it is reinforced to proper thickness. Where the thin area is large it is frequently advisable to put on a patch instead of building up the plate.

Vibrating Screen Frames

Vibrating screen frames are subjected to severe duty and frame breakage is not unusual. They may be welded with mild steel coated electrodes and made more rugged than when new.

Screen Cloth or Plates

Certian parts of manganese screens usually get harder wear than the rest of the screen and may become thin in spots. If it were not possible to build up these screens with welding, it would mean that the entire screen would have to be discarded and a new one secured. Using a high manganese steel electrode, screens can be built up to their original thickness and strength.

Shafting

The presence of large quantities of fine dust in a rock products plant frequently causes shafts to wear rapidly at stuffing boxes, bearings, etc. Such worn shafts may be built up with ordinary mild steel electrode and then turned down to proper size, thus reclaiming an otherwise worthless shaft. For most applications it is best to run beads parallel to the axis of the shaft, rotating the shaft 180 deg. after every bead in order to keep the heat equalized on each side.

Truck Frames

Shovels load rock into cars or motor trucks. Frames of these are steel castings and often an especially heavy load of rock is sufficient to break the frame. These frames can be welded very easily with a heavily coated steel electrode.

Crane Booms

Crane booms which have become damaged, weakened or loosened may be made stronger

and stiffer than new booms by welding on patches or replacing damaged members.

Caterpillar Track Sprockets

Worn teeth on caterpillar track sprockets need not be discarded. They may be built up by depositing layers of heavily coated mild steel electrode until the tooth is shaped to normal size, and then hard surfaced with a high carbon steel rod. Copper dams may be clamped to the size of the sprocket to facilitate building up and shaping.

Pinions

Cast steel racks and pinions may be built up in the same manner as the track sprockets described above.

Chutes and Hoppers

When new chutes or hoppers are required, it is a simple matter to cut the plates, usually ¼ in. thick, to shape and weld them together. If it is necessary to lay out such jobs for riveting and have them made outside, it would cost 200 per cent or 300 per cent more than building the parts by welding.

Parts on chutes which are subject to abrasive action may be hard surfaced with a high carbon steel or high manganese steel electrode.

Shovel Points

Shovel points may be built to size and hard surfaced with the manganese steel electrode. Care should be taken not to overheat the tooth, and to thoroughly clean and peen each bead as deposited.

Gyratory Crushers

The cast iron spiders in gyratory crushers receive the impact of the rock as it is dumped into the crusher. Consequently, they wear rapidly. One plant has been successful in building up spiders which are excessively worn by welding on a pad of 18-8 stainless steel and then applying a layer of high manganese steel electrode for a protective coating. Spiders reconditioned in this manner may be kept in excellent shape by simply adding a layer of manganese steel when necessary. (See Fig. 1.)

It has been found that the crushing action is accelerated and improved by building up ribs on the liners of concaves of gyratory crushers. For these 3/16-in. and ¼-in. manganese steel electrodes have been found most satisfactory. Fig. 2 shows a sketch of a completed job and a detail of one concave showing the method of ribbing.

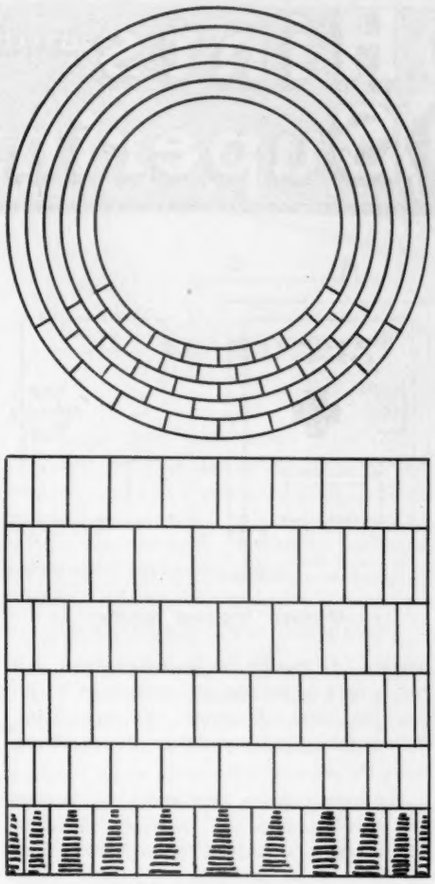


Fig. 2. Above: View of crusher lining looking down from the top showing manganese concaves forming the wall. Below: Circular wall of concaves laid out in the flat showing bottom row built up with pads of manganese steel electrodes

An interesting welding application which was called to the attention of the writer recently concerned building up ribs on the chilled cast-iron heads of gyratory crushers. These heads, weighing several tons, are practically worthless after the chilling has worn through. After some experimentation the maintenance man at the plant in question worked out a welding technique which seems to be highly satisfactory. Using high manganese steel rods, short beads not exceeding 2 in. in length were laid on one rib, then, skipping to another rib, a 2-in. bead was laid, and this procedure continued, being careful not to get the head too warm. Each bead was peened carefully as it cooled. Beads were laid transverse to the axis of the shaft as shown in Fig. 3.

Using a manganese steel electrode on chilled cast iron is a somewhat unusual procedure and it is not to be assumed that this method can invariably be followed with satisfactory results.

Where the crusher heads are manganese castings, it is, of course, a simple matter to build up the ribs with manganese electrodes. In such case wide beads are run lengthwise of the head, each bead being thoroughly cleaned and peened.

Broken Manganese Steel Parts

For the repair of broken manganese steel parts, many plants have found the use of a special austenitic alloyed steel coated electrode highly satisfactory. This method is used for the repair of shovel buckets, dipper teeth, frogs, crossings, switch points and other manganese steel parts. This is, of course, for the repair of breaks or filling in of cracks. For providing a wearing surface on such parts, manganese steel electrodes are used.

The savings which can be made by arc welding as outlined in this article are obvious. Even if a welding machine is kept busy only half time, it is frequently true that it soon pays for itself.

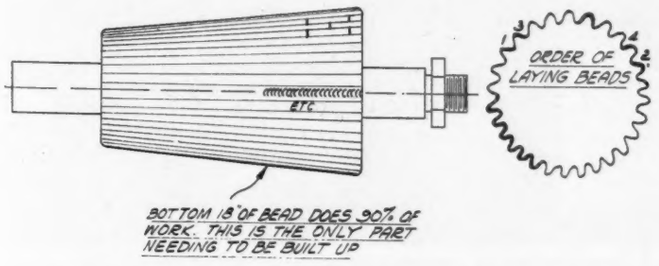


Fig. 3. Method of building up chilled cast iron head

Michigan Group Buys Lime Property in Oregon

THE Oregon Lime Products Co., Grants Pass, Ore., has been organized and has taken over the assets of the Oregon Lime Stone Products Corp., which has been in existence for some years. The new company is composed of three Detroit, Mich., men, F. I. Bristol, president; H. B. Penniger, vice-president; J. W. Penniger, secretary-treasurer; and one Oregon man, I. W. Turpin of Portland. The organization was completed last week, and offices and warehouse will be established in Grants Pass without delay. The company will deal in commercial lime, agricultural lime, lime stone, poultry grit, etc., and it is expected that operations will be commenced within three weeks. The quarries are located in the Williams Creek district, and the products will be trucked to Grants Pass for shipment. The officers of the company will reside in Grants Pass. Mrs. J. W. Penniger and baby recently arrived from Detroit.

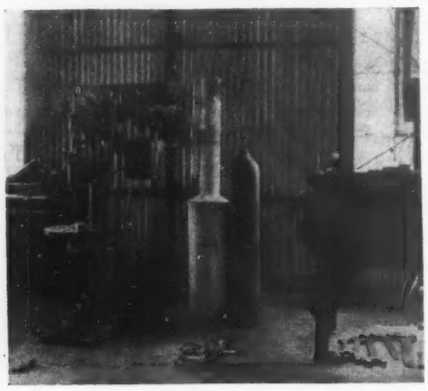
Lack of "Stretch" Not of "Strength"

ANNOUNCEMENT of a new conveyor belt by the Manhattan Rubber Manufacturing Division of the Raybestos-Manhattan, Inc., Passaic, N. J., on p. 47, ROCK PRODUCTS, July 25, described the belt as having "greater flexibility, lack of strength, and puncture proof" qualities claimed for it. A typographical error made *"lack of stretch"* read "lack of strength," for which the editors apologize.

Hints and Helps for Superintendents

Generators for Small Plants

AT KINGMAN, Ariz., is one of the plants of the Consolidated Feldspar Corp., and while it is a small plant and employs only a limited number of men, it believes in providing its workmen with the best and most modern of tools. It is indeed aggravating to be out of "gas" when a welding job is to be done. Most small plants depend



Portable gas unit

on cylinder storage, but at this plant operators have found the portable gas generator of the American Carbide Co., Duluth, Minn., is satisfactory in eliminating this difficulty.

Tractor Pusher

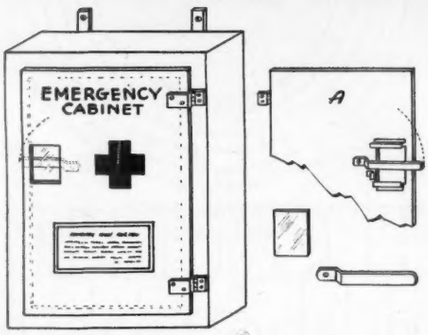
AT an operation on the Pacific Coast, where materials are handled from barges, boats, etc., to docks, a Fordson tractor has been fitted with a front section of perforated steel plate which acts as a bumper. The perforations in the steel plate allow air to reach the radiator thus eliminating possible troubles from that source.

The Fordson is used for many purposes around the place and the bumper is used for pushing trucks, boxes, crates, or what have you, and in a pinch can be used as a road scraper by simply lowering the steel plate to the desired clearance.

A Theft-Proof Emergency Cabinet

TO PREVENT workmen from obtaining possession of material inside of the emergency first-aid cabinet too readily, the plan illustrated was devised.

The sheet metal cabinet has a panel cut out measuring 2½x3½ in. on the left-hand side of the door. This panel is closed by sliding a piece of glass into grooved members as shown at *A*. A bar of iron ¼x¾x5 in. long swings on a pin back of this glass



Modern first-aid cabinet

window. In closing the door of cabinet, this bar is held in an upward position so it will pass the frame of cabinet. As door closes, the bar drops into position as illustrated and locks the door securely.

The glass panel is held at the top, bottom and right hand side by the metal channels. Glass cannot be pushed to the left because its edge rests flush against the cabinet frame when door is closed.

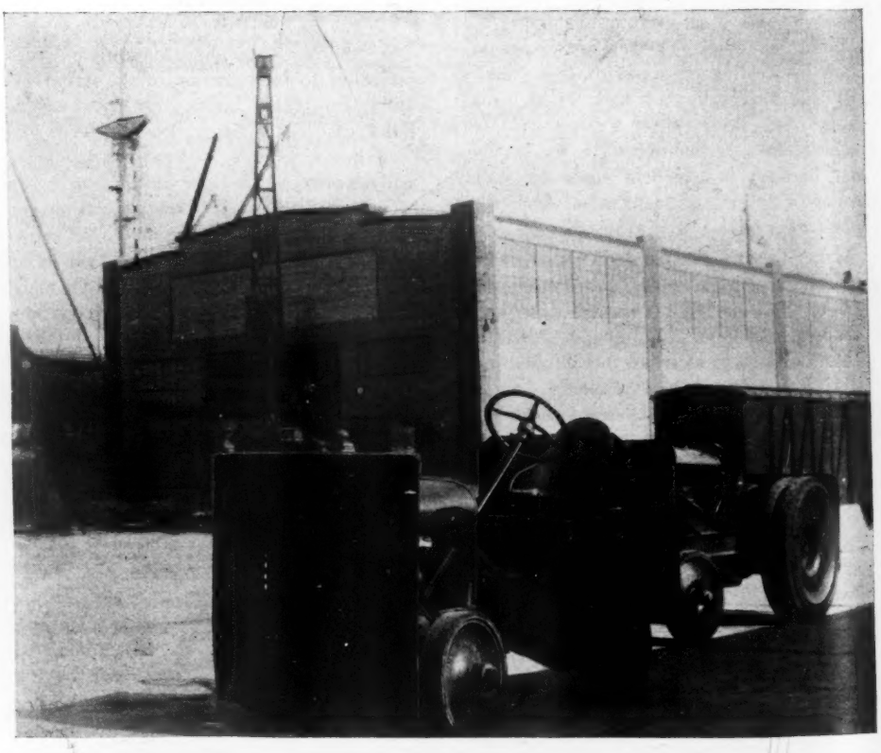
In an emergency—glass panel is broken, latch is raised and door opened. On the inside of cabinet are additional pieces of glass cut to correct size. One of these is again slipped into the channels of door—bar is raised—door closed and bar drops down into position—locking door against the indiscriminate handling of contents.

Rules on the front of cabinet make it compulsory for the one breaking the glass to make a full report of reason for doing so and turning in an itemized list of supplies removed from cabinet so that duplicate items can be immediately substituted.

Welding High Manganese Steel

MANGANESE steels are being used with increasing frequency for many parts that are subjected to excessive shock or abrasion. The constant abrasion which these steels often encounter eventually results in wearing away the steel to the extent that building up of the worn surface becomes necessary. Consequently, the repair and rebuilding of manganese steel parts is a subject of interest in many industries.

The manganese steel most commonly used for resistance to shock and abrasion has a manganese content of from 12 to 14% and is commonly called Hadfield steel. Hadfield steel has a higher coefficient of expansion and lower thermal conductivity than has plain carbon steel, properties that must be



Pusher attachment on tractor

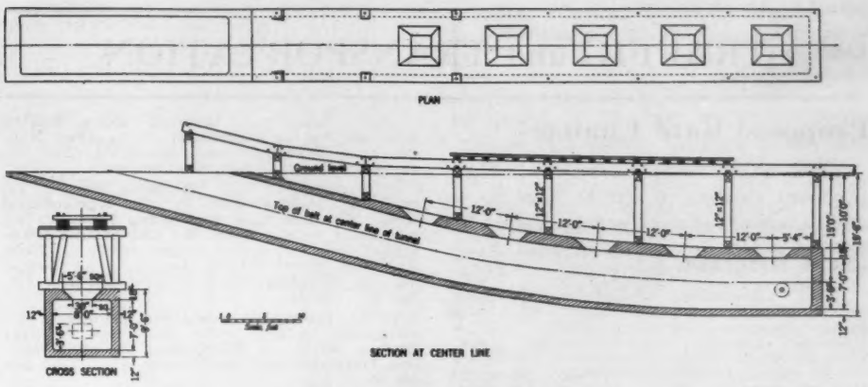
constantly kept in mind during welding, because subsequent shrinkage may crack the metal. The proper procedure control for welding manganese steel castings by the oxy-acetylene process was recently outlined in *Oxy-Acetylene Tips* as follows:

To prepare a casting for welding, the edges should be beveled to a 90 deg. total vee. This should be done either by grinding or by cutting with the oxy-acetylene blowpipe. If cut by the latter method, the edges should be ground or pickled to remove any adhering oxide.

The casting should then be prepared for welding by preheating in a manner similar to that used for ordinary cast iron. Large castings should be heated slowly in a charcoal fired preheating furnace made of bricks, while for small castings a kerosene preheating torch or the welding blowpipe may be used. Since manganese steel is brittle in the temperature range of 450 to 1000 deg. C. the work should be carefully supported during preheating and welding. Welding should be done in the preheating furnace, care being taken to protect the casting from drafts or sudden chilling while hot.

A comparatively large welding tip should be used and a fairly large puddle of melted metal should be maintained continually. The rod should not be rubbed in the weld; the end of the rod should be kept under the surface of the puddle and the blowpipe flame applied to melt the rod in the puddle of molten metal. When the puddle has been built up sufficiently, it should be melted in the base metal by directing the flame around the edges until the weld metal and the base metal flow together through their own fluidity. Care must be taken, however, to avoid building up too large a puddle, because it may flow over onto the solid metal with the result that there will be no fusion between the weld metal and the base metal.

If the weld may be required to withstand a considerable amount of stress the entire casting should be reheated to a uniform temperature of about 1060 deg. C., held at this temperature for about 30 min. and then quenched in water. Pouring water on the heated metal is not sufficient; for proper heat treatment. the castings should always be entirely immersed in the water.



For tunnel transportation

A sound weld made under these conditions will give satisfactory results where an unusual amount of strength in the welded part is not required; it will be entirely satisfactory for resistance to abrasion and to a considerable amount of shock.

Stockpiling Raw Material Ahead of Plant

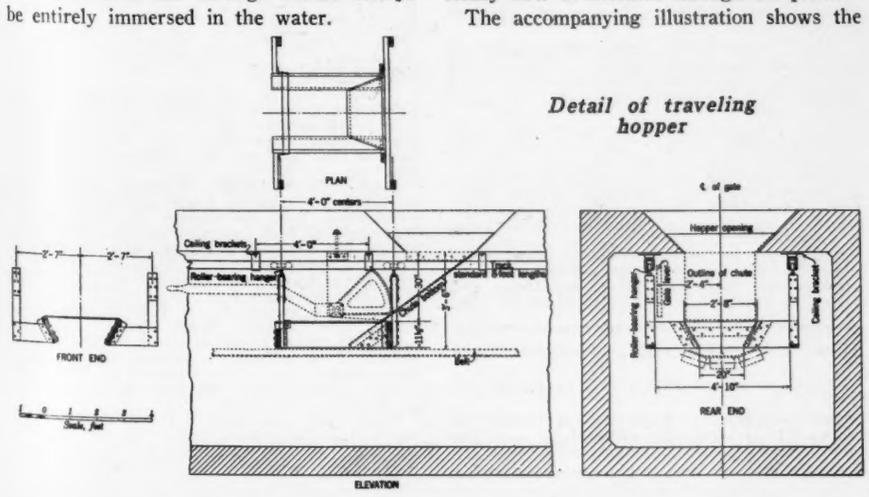
AT the Eliot, Calif., sand and gravel plant of the Pacific Coast Aggregates, Inc., raw material containing 20% of boulders larger than 3 in. is brought to the plant in train loads on standard-gage track in 30-ton automatic air-dump cars. The method of feeding the plant is out of the ordinary. The cars are spotted on a trestle over a dump pit as shown in the accompanying illustrations.

A reinforced-concrete conveyor tunnel extends under the full length of the pit and five 24-in. feed gates are distributed along the roof of the tunnel. A surge storage of about 150 cu. yd. of pit-run material is maintained in the dump pit and the feederman is enabled, by using successive gates, to keep the plant running during short shutdowns of either shovel or transportation equipment for moving track or for minor repairs. Hand feed control by the man stationed at this point has been found more satisfactory than any mechanical devices such as apron or reciprocating feeders; the judgment of an experienced man for this duty is vital to a steady flow of material through the plant.

The accompanying illustration shows the details of the traveling hopper running on roller-bearing trucks on a track hung from the tunnel ceiling; this arrangement enables the pit-man to move from one gate to another as the need arises. The chutes and quadrant gates shown by dotted lines are fixed at each opening to the hopper above.

A 30-in., 7-ply, rubber-covered conveyor belt operating horizontally and up an incline of 18 deg. takes the raw material from the dump hopper to the primary mill. This belt is 200 ft. between centers and has a $\frac{1}{16}$-in. rubber top and $\frac{3}{32}$-in. bottom and a life of 750,000 tons. The drive is a 50-hp. motor directly connected through a tandem drive set on the ground level.

This and other details of the plant are described in U. S. Bureau of Mines I. C. 6705, by Edward B. Kendall, vice-president and operating manager.



Detail of traveling hopper

Lunchroom

PLANT CLEANLINESS is often ruined by the thoughtlessness or carelessness of workmen who are prone to throw bits of their lunch or waste from the lunch about the plant.

Temporary lunchroom

Six Companies, Inc., which is building the Hoover dam, is one concern that will not tolerate such procedure. It has provided sheds with suitable benches and tables at which to eat. The illustration shown was taken at the sand and gravel plant of that company near Boulder City, Nev. This lunchroom is kept spick and span, with all waste paper and bits of lunch burned in a nearby incinerator.

TRAFFIC and TRANSPORTATION

Proposed Rate Changes

THE FOLLOWING are the latest proposed changes in freight rates up tc and including the week ending August 19:

New England

30197. **Limestone,** ground, in packages, minimum weight 80,000 lb., from Ashley Falls, Cheshire, Farnams, North Adams, Renfrew, Zylonite and Richmond, Mass., Canaan, Falls Village, Danbury, E. Canaan, Conn., Lee and West Stockbridge, Mass., to Brooklyn stations, N. Y. Present—14. Proposed—$2.50 N. T. (To expire 12/31/33.) Reason—Same rate as currently effective to N. Y. Hbr. Ltge. points.

Trunk Line

31198. **Crushed stone, coated with oil, tar and asphaltum,** C. L. (See Note). (Note—The oil, tar and/or asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping orders and bills of lading.) (See Note 2), from Reading, Rock Hill and Shainline, Pa., to stations on the Reading Company system and Pennsylvania-Reading Seashore Lines. Rates ranging from 73c to $1.63 per net ton.

31202. **Moulding sand,** C. L., (See Note 2), from South Schenectady, Schenectady, Mechanicville, Delmar and Slingerlands, N. Y., to Albany, N. Y., 70c per net ton.

M-3239. To establish rate of $1.70 per net ton on **crushed gypsum rock,** C. L., from New York State producing points to Portland Point, N. Y.

Sup. 1 to 31124. (A) **Building lime,** C. L., minimum weight 30,000 lb., (B) **Agricultural, land, chemical, gas and glass lime,** C. L., minimum weight 30,000 lb., also **ground limestone,** C. L., minimum weight 50,000 lb., from Alba-Marl Lime Co., W. Va., Buckeystown, Md., Capon Road, Cedar Creek, Va., Charles-Town, Engle, W. Va., Frederick, Grove, Keller, Md., Martinsburg, Millville, Natural Lime Marl Co. Siding, W. Va., Oranda, Va., Security, Md., Stephens City, Strasburg, Strasburg Jct. and Vaucluse, Va., to Hillsdale, N. Y. (A) 24½c and (B) 24c per 100 lbs.

31213. **Limestone, unburned, ground,** C. L., minimum weight 50,000 lb., from Natural Bridge, N. Y., to Wachusetts, Mass., and Fitchburg, Mass., 18c per 100 lb. (Present rate 24c per 100 lb., sixth class.)

31219. **Ground limestone,** C. L., minimum weight 50,000 lb., from Lebanon Valley district, Annville, Brownstone, Donaghmore, Hummelstown, Myerstown, Palmyra and Swatara, Pa., to Carney's Point, N. J., $1.90 per net ton.

31231. **Stone, crushed,** C. L., (See Note 2), from Pounding Mill, Va., to C. & O. Ry. stations, Ashland, Buchanan, Holt, Rock Branch, White House, Stafford, Dobson, Carver, Van Lear, Prestonburg, Martin, Orkney, Lambert, Wheelwright, May, Garrett, Keyser, Shelby, Collins, Dorton, Greasy Creek, Marrowbone, Rockhouse, Coaldale, Dunleary, Ky., and various. Rates ranging from $1.20 to $1.70 per net ton.

31234. **Gravel and sand,** N. O. I. B. N., in Official Classification, except blast, engine, foundry, glass, moulding, quartz, silex and silica, (See Note 2), from Kenvil and Succasunna, N. J., to Lincoln, N. J., $1.10 per net ton.

Sup. 1 to 31165. **Ground limestone,** C. L., minimum weight 60,000 lb., from Thomasville and Bittinger, Pa., to Trenton, N. J., $2 per net ton.

31246. **Crushed stone, coated with oil, tar or asphaltum,** C. L., (See Note 2), from Devon, Pa., to Boyce, Va., $2.15 per net ton.

31251. **Crushed stone and stone dust,** C. L., (See Note 2), from South Bethlehem and Feura Bush, N. Y., to Albany and West Albany, N. Y., 65c per net ton.

31256. To cancel present commodity rate of 39c per 100 lb. applicable on **sand and gravel,** C. L., from Jersey City, N. J., to Manville, N. J., incl., shown in C. N. J. I. C. C. G-3850; to St. John and Fredericton, N. B., as published in C. N. J. I. C. C. G-4081.

31261. **Crushed stone and stone screenings,** C. L., in open top equipment, (See Note 2), from Erie, Pa., to destinations in the state of Pennsylvania west of a line drawn from Sand Patch, Pa., on the B. & O. R. R., to Cresson, Pa., on the P. R. R., thence due north to the Pennsylvania-New York state line. Rates ranging from 60c to $1.60 per net ton.

31246. (Sup. 1.) **Crushed stone, coated with oil, tar or asphaltum,** C. L. (See Note 2), from Reading and Shainline, Pa., to Boyce, Va., $2.15 per net ton.

31124. (Sup. 2). (A) **Building lime,** C. L., minimum weight 30,000 lb. (B) **Agricultural lime, chemical, gas and glass lime,** C. L., minimum weight 30,000 lb., also **ground limestone,** C. L., minimum weight 50,000 lb., from Riverton, Toms Brook, Linville and Zirkle, Va., to Hillsdale, N. Y. (A) 24½c and (B) 24c per 100 lb.

31272. **Limestone, unburned, ground,** C. L., minimum weight 50,000 lb., from Natural Bridge, N. Y., to Mifflinburg, Ralston, Milton, Dalmatia and Middleburg, Pa., 21½c per 100 lb.

Central

36551. To establish on **gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica, in open top car, C. L., from Cleveland, O., to Grove City, Pa., rate of 130c per N. T., plus emergency charge, via P. R. R., Shenango, Pa., B. & L. E. R. R. Present, 16c (6th class).

36555. To establish on **crushed stone** in closed cars, C. L., from Chicago, Ill., to New Albany, Ind., rate of 230c per N. T., plus emergency charge.

36585. To establish on **rock, bituminous asphalt,** C. L., min. wt. 40,000 lb., from East St. Louis, Ill., to Cleveland, O., rate of 370c per N. T. to apply only as a proportional rate on traffic originating at points in Missouri.

36651. To establish on **stone, crushed** (in bulk), and **crushed stone screenings** (in bulk), in open top cars, carload, from West Columbus and Highway, O., to Lancaster, O., rate of 60c per net ton.

36655. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass grinding or polishing, loam moulding or silica) and **gravel,** in open top cars, C. L., from Kenneth and Lake Ciecott, Ind., to Alexandria, Ind., rate of 90c per net ton via P. R. R., Elwood, Ind., and N. Y. C. & St. L. R. R.

36712. To establish on **crushed stone,** C. L., to Willard, O., from Bellevue, O., present 70, proposed 60; Maple Grove and Narlo, O., present 80, proposed 65.

36714. To establish on **sand,** in open top cars, C. L., from Kern, Ind., to Lake Village, Ind., rate of 65c per net ton, plus emergency charge, to expire December 31, 1933.

36716. To establish on **crushed stone** and/or **crushed gravel,** coated with oil, tar or asphaltum, C. L.

Note—The tar, oil and asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping orders and bills of lading.

From Charleston, W. Va., district to (C. & O. Ry.). All stations in West Virginia (B. & O. R. R.). All stations in West Virginia, Terre Alta, W. Va., and west and Morgantown, W. Va., and west (N. & W. Ry.) Kenova, W. Va., to Bluefield, W. Va., inclusive (W. M. Ry.). All stations in West Virginia, Harrison, W. Va., and west, rates on basis of 10c per net ton over the single or joint line Buckland scale rates for the distances involved. Destination territory mentioned above to include branch line as well as main line stations.

36718. To establish on **calcined gypsum** (an unfinished product for further manufacture), C. L., minimum weight 80,000 lb., from Grand Rapids, Mich., to Cleveland, O., rate of 265½c per net ton.

36735. To establish on **sand, burnt or refuse foundry,** in open top cars, Cleveland to Sandusky, O., 113c net ton.

36736. To establish on **moulding sand,** C. L., Fairview, Feigel's Siding, Hardy, Hatfield, Kensington, Kincaid, McCoy, Richland, Rockport, Sandale, Ind., to Port Washington, Wis., 300c net ton.

36820. To establish on **sand, blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding and silica,** in open top cars, from Henlein, Pa., to points in Pennsylvania shown in Exhibit "A" attached.

EXHIBIT "A"

From Henlein, Pa.
(Rates in Cents Per 100 Lbs.)

To	Proposed	*Present
Aliquippa, Pa.	110	139
Aspinwall, Pa.	120	139
Bairford, Pa.	90	139
Beaver Falls, Pa.	100	113
	100	113
Bessemer, Pa.	100	139
Bradys Bend, Pa.	110	113
Butler, Pa.	80	113
	120	139
Carnegie, Pa.	120	139
	120	139
Corry, Pa.	110	139
	110	139
Ellwood City, Pa.	110	113
	100	...
Erie, Pa.	90	101
Franklin, Pa.	100	113
	100	113
Glassport, Pa.	130	139
	100	139
Homestead, Pa.	120	139
	120	139
Midland, Pa.	110	113
	120	139
McKeesport, Pa.	120	139
	120	139
Meadville, Pa.	70	76
Natrona, Pa.	110	139
New Kensington, Pa.	120	139
	100	113
Oil City, Pa.	100	113
	120	139
	120	139
Pittsburgh, Pa.	120	139
	120	139
Rochester, Pa.	110	113
Tarentum, Pa.	110	139
Trafford, Pa.	120	176
Verona, Pa.	120	139
Washington, Pa.	130	176
	130	176
Wilmerding, Pa.	120	164

*Per B. & L. E. R. R. I. C. C. No. 942, P. S. C. Pa. No. 576.

36835 (2). To establish on **crushed stone** and/or **crushed gravel,** coated with oil, tar or asphaltum, C. L., from Cincinnati, O., (rates in cents per N. T.):

To	Proposed	*Present
Cheviot, O.	68	180
Bridgeton, O.	68	180
Miami, O.	68	180
Willey's, O.	67	220
Fernald, O.	67	220
Shandon, O.	84	220
Okeana, O.	84	220
New Kirk, O.	84	220
Peoria, Ind.	107	240
Raymond, Ind.	107	240
Bath, Ind.	119	240
Cottage Grove, Ind.	119	240
Kitchell, Ind.	119	260
Witts, Ind.	119	260
Boston, Ind.	119	260
Richmond, Ind.	130	260

*Sixth class.

Note—The oil, tar, and/or asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping order and bills of lading.

36821. To establish on **crushed stone,** Whitehouse, O., to Decatur, Ind., 110c net ton, subject to emergency charge. Present, 138c net ton, subject to emergency charge. Route, Wabash Ry., Ft. Wayne, Ind., P. R. R.

36851. To establish on **limestone sand,** C. L., from Bluffton, Ind., to Ft. Wayne, Ind., rate of 50c per N. T. Present—200c per N. T.

36858. To establish on **limestone,** ground or pulverized, limestone screenings; loaded in box cars, carload, minimum weight 60,000 lb., from Greencastle, Ind., to points in C. F. A. territory except to points in Indiana on intrastate movements, rates on basis of 60% of sixth class.

36860 (2). To establish on **agricultural limestone,** carload, minimum weight 50,000 lb., to Milwaukee, Wis. (for beyond), from Gibsonburg, Maple Grove and Woodville, O., rate of 240c per net ton. Present, 280c per net ton.

36898. To establish on **sand and gravel,** C. L., from Winona Lake and North Yard (Warsaw), Ind., to Bippus, Bolivar, Disko, Huntington, Laketon and Servia, Ind., rate of 70c per net ton to expire with December 31, 1933. Present, 88c to Bippus; 80c, Bolivar; 75c, Disko; 88c, Huntington; 80c, Laketon; 88c, Servia, Ind.

36899. To establish on **sand** (other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica) or gravel, C. L., from Saegertown, Pa., to Jamestown, Pa., rate of 70c per net ton via Erie R. R., Amasa R. R., N. Y. C. R. R.

36767. To establish on **stone,** crushed (in bulk), and **limestone,** unburned, agricultural (in bulk in open top cars only), C. L., from Black Rock, Buffalo and East Buffalo, N. Y.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

To	Proposed	Present
Farnham, N. Y.	70	80
Irving, N. Y.	70	80
Silver Creek, N. Y.	70	80
Waites Crossing, N. Y.	70	80
Dunkirk, N. Y.	80	83
Fredonia, N. Y.	80	90
Laona, N. Y.	80	90
Nortons, N. Y.	80	90
Cassadaga, N. Y.	80	90
Moons, N. Y.	80	90
Sinclairville, N. Y.	90	100
Gerry, N. Y.	90	100
Falconer, N. Y.	90	100
Frewsburg, N. Y.	90	100

36774. To establish on **stone**, crushed, coated with oil, tar or asphaltum, C. L., Waterville, O., to Iron Mountain, Mich., *383c N. T. and †372 N. T.

*Via N. Y. C. & St. L. R. R., Chicago, Ill., C. & N. W. Ry.

†Via N. Y. C. & St. L. R. R., Chicago, Ill., C. M. St. P. & P. R. R.

Southwestern

1486. **Silica sand,** from Festus, Mo., to Alton, Ill. To establish a rate of 112c per ton of 2,000 lb., not subject to emergency charge, on silica sand, C. L., (See note 2), but not less than 60,000 lb. except when car is loaded to full visible capacity, actual weight will govern, from Festus, Mo., to Alton, Ill. (Present rate, 133c.)

1646. **Crushed stone,** from Moline, Kan., to Pawnee, Tonkawa, Bartlesville, Okla. To establish rates of 98c to Pawnee, Okla., 90c to Tonkawa, Okla., and 82c per ton of 2,000 lb. to Bartlesville, Okla. (not subject to emergency charge), from Moline, Kan., on crushed stone (broken stone, ranging in size up to 200 lb. in weight), including ground limestone, in bulk or in bag, but not including gypsum rock or asphalt, C. L., (See Note 3).

Southern

2107. **Mica,** dry ground, C. L., and mica schist, dry ground and/or screened, C. L., Kings Creek, S. C., to Atlanta, Ga., Mobile, Ala., New Orleans, La., and Port Wentworth, Ga. At present, class or combination rates apply. It is proposed to establish rates on mica, dry ground, carload, minimum weight 50,000 lb. Mica schist, dry ground and/or screened, minimum weight 60,000 lb., from Kings Creek, S. C., to Atlanta, Ga., 408c per net ton; Mobile, Ala., 27½c per 100 lb.; New Orleans, La., 29c per 100 lb.; Port Wentworth, Ga., 26c per 100 lb.—made with relation to rates currently in effect from Biltmore and Spruce Pine, S. C.

2441. **Sand and gravel,** C. L., between points on the Artemus–Jellico R. R., on the one hand, and points on other lines in southern territory, on the other. It is proposed to amend Agent Speiden's Tariff 388–A, I. C. C. 1635, by adding the Artemus–Jellico R. R. to List 2 (pages 446 and 447 of tariff), thereby providing for application of the customary joint trunk–relief line scale in arriving at rates to and from points on this line. Reference should be made to Artemus–Jellico Tariff I. C. C. 4 (or reissues thereof) for list of stations and distances to be used in determining rates to apply. It is also proposed to specifically publish a rate of 175c per net ton (emergency charge to be added) from Louisville, Ky., to Anchor, Ky., and from Ellerson, N. C., to Anchor and Kayjay, Ky. Routing to be provided via L. & N. R. R. direct through Lebanon, Ky., to Artemus, Ky., Artemus–Jellico R. R. beyond, when from Louisville, Ky., and from Ellerson, N. C., via Sou. Ry. (via Newport Junction), to Knoxville, Tenn., L. & N. R. R. Artemus, Ky., Artemus–Jellico R. R. beyond.

2444. **Gypsum,** crude or crushed (not ground), C. L., from Plasterco and Saltville, Va., Memphis, Tenn. (when from beyond), New Orleans, La., Mobile, Ala., Pensacola, Fla., and Gulfport, Miss. It is proposed to revise the commodity description on crude gypsum, C. L., from Plasterco and Saltville, Va., Memphis, Tenn. (when from beyond); New Orleans, La., Mobile, Ala., Pensacola, Fla., and Gulfport, Miss. (applicable only on coastwise traffic) to points in Alabama, Georgia, Tennessee, and Tampa, Fla., as follows: "Gypsum, crude or crushed (not ground), in bulk, C. L. (See Note 3), but not less than 60,000 lb."

Illinois

7440. **Sand, gravel, crushed stone and/or slag,** treated with oil, tar or asphaltum (See Note below), C. L., (See Note 3).

Note—The oil tar and/or asphaltum not to exceed 10% by weight of the commodity as shipped, the shipper to so certify on shipping orders and bills of lading.

FROM CHICAGO, ILL.

To	Pres., per 100 lb.	Prop., per net ton
Danville, Ill.	17c	$2.00
Paris, Ill.	18c	2.20
Marhall, Ill.	19c	2.40

7455. **Crushed stone, gravel** and/or sand, coated with oil, tar or asphaltum, C. L., (See Note 3), but not less than 40,000 lb., from Joliet, Ill., to points in I. R. C. territory:

Present class rates.

	Proposed A	Proposed B
25 miles and under	96	116
40 miles and over 25	107	127
60 miles and over 40	119	139
75 miles and over 60	130	150
100 miles and over 75	142	164
200 miles and over 175	199	219
300 miles and over 275	257	277
325 miles and over 300	268	288

A—Single Line.
B—Joint Line.

7457. **Crushed stone,** C. L., (See Note 2), from Krause and Stolle, Ill., to Horseshoe Lake on Illinois Terminal R. R. Rates per net ton, present, 73; proposed, 54 (including emergency charge).

7458. **Sand and gravel,** C. L., (See Note 2), but not less than 60,000 lb., from Lincoln, Ill., to Alton R. R. stations, San Jose to Ellis, Ill., inclusive.

3330–U. **Sand and gravel,** C. L., marked capacity of car, from Chillicothe, Ill., to M. & St. L. R. R. stations, rates in cents per net ton (emergency charges in addition).

To	Pres.	Prop.
Monmouth, Ill.	100	90
Eleanor, Ill.	101	90
Little York, Ill.	101	90
Seaton, Ill.	101	90
Ogle, Ill.	113	90
Keithsburg, Ill.	113	90

Western

7270–E. Rates, **stone,** crushed, C. L., (See Note 3), but not less than 40,000 lb., from Dell Rapids, S. D., to Cherokee, Iowa Falls and Rock Rapids, Ia.

To	Present	Proposed
Cherokee, Ia.	*170c plus 6	110c plus 6
Iowa Falls, Ia.	†200c plus 6	170c plus 6
Rock Rapids, Ia.	143c plus 6	63c plus 6

*Intermediate with Alta, Ia.
†Intermediate with Aplington, Ia.

8561. Rates: **Stone,** crushed, C. L., (See Note 3), but in no case shall the minimum weight be less than 40,000 lb., from Wausau, Wis., to Wilmington, Ill. Rates, Present—216c per net ton, Joliet, Ill., combination. Proposed—180c per net ton.

7283–2. Rates, **sand,** other than silica, bank, blast, glass, engine, fire or furnace, filtering, foundry, moulding, grinding or polishing, or loam sand, C. L., (See Note 3), from Pacific, Jedburg and Yeatman, Mo., to Belleville, Ill. Rates present, combination over E. St. Louis, Ill.; proposed $1.10 net ton.

774–E. Rates, **stone,** crushed; **stone,** rubble, of irregular random widths, lengths and thicknesses, not trimmed or tooled, not suitable for manufacture, cutting, or dressing, actual value at origin point not in excess of $4.50 per ton of 2,000 lb., C. L., (See Note 2), but not less than 40,000 lb., from Rapid City, S. D., to St. Paul, Minneapolis and Minnesota Transfer, Minn. Rates, present, 24½c; proposed, 20c per 100 lb.

I. C. C. Decisions

24568. Sand and Gravel. Missouri Gravel Co. vs. C. B. and Q. Railroad. By division 5. Upon reconsideration, finding in the original report, 190 I. C. C. 465, pertaining to rates in the past on sand and gravel from La Grange, Mo., to destinations in Illinois, modified, so that finding No. 3 in the former report will read as follows: "We find that . . . (3) the class E rates assailed from La Grange and Reading and the 111 and 126 cent commodity rates from La Grange to the key destinations and respective intermediate points, except to Adair, Table Grove, and Vermont, were unreasonable in the past to the extent that they exceeded the rates designated as prescribed in Appendix A. . . ."

25313. Ground Barytes. Humble Oil and Refining Co. vs. A. T. and S. F. Railroad, et al. By division 3. Dismissed. Rates on ground barytes, not precipitated, in cloth bags, C. L., Los Angeles, Calif., to Hobbs, N. M., held not unreasonable.

14794 and 14964. Crushed Stone, Etc. Fourth section. By division 2. Authority granted to establish lowest rates on crushed stone or terrazzo aggregate in bulk or in bags, in box cars, and crushed granite in bags, C. L., over all routes between points in southern territory, on the one hand, and destinations in trunk line territory (including Buffalo-Pittsburgh territory) and New England, on the other, over which they have been granted relief from the long-and-short-haul part of section 4 in Southern Class Rate Investigation, 100 I. C. C. 513, 109 I. C. C. 300, 113 I. C. C. 200, and 128 I. C. C. 567, that may be constructed over any line or route between the same points on the basis prescribed or approved for terrazzo aggregate in stone, marble and slate from or to southern points, 183 I. C. C. 611, without reducing rates at intermediate points, subject to the usual aggregate of intermediates limitation and to the further limitation that the rates established shall not exceed those authorized in the case last cited.

14506 and 14531. Sand and Gravel. By division 2. Authority to establish rates over all routes between points considered in Sand, Gravel, and Crushed Stone, 177 I. C. C. 621, as well as from and to points in Louisiana and Texas on sand, gravel, and related commodities equal to the lowest that may be constructed over any line or route on the basis prescribed in that case and on pulverized oyster shell screenings rates the same as those on ground limestone and to maintain higher rates from, to and between intermediate points, provided that the rates at the higher rated intermediate points shall not exceed the basis prescribed or approved in the case mentioned and also subject to the 33⅓, 50 and 70% circuity limitations.

15002. Cement. Fourth Section. By division 2. Ash Grove Lime and Portland Cement Co. vs. C. B. and Q. Railroad Co. Authority granted, on conditions, to maintain rates on portland cement, C. L., from Louisville, Nebr., to points in Minnesota, North Dakota, and South Dakota without observing the long-and-short-haul provision of section 4.

14460. Asphalt Rock and Limestone. Fourth Section. By division 2. Relief from the long-and-short-haul provision of section 4 in rates on asphalt rock or stone, coated with road oil, in carloads, from and to points in the Southwest, authorized in 186 I. C. C. 571, modified to include chatts, gravel, and sand, coated with oil, tar, or asphalt, in carloads.

3766. Cement Switching. By division 3. Schedules proposing an allowance of $2 per car to the Monarch Cement Co. for terminal switching by that company of line-haul traffic to and from its plant at Humboldt, Kans., found not justified. Suspended schedules ordered canceled and proceeding discontinued, but without prejudice to any finding that may be made in Ex parte 104, *Practices of Carriers Affecting Operating Revenues or Expenses,* Part 2, Terminal Services.

25327. Molding Sand. Creamery Package Manufacturing Co. vs. Boston and Maine Railroad. By division 2. Rate charged on one carload of molding sand from Schuylerville, N. Y., to Fort Atkinson, Wis., found inapplicable. Reparation awarded. (*See page* 82.)

Recent Quotations on Rock Products Securities

Stock	Date	Bid	Asked	Dividend
Allentown P. C., com.[47]	8-24-33	2½	5	
Allentown P. C., pfd.[47]	8-24-33	7	10	
Alpha P. C., com	8-23-33	15½	18	
Alpha P. C., pfd	8-18-33	70	....	1.75 qu. June 15, '33
Amalgamated Phos. 6's, '36[47]	8-24-33	94	96	
American Aggregates, com.[47]	8-24-33	1	5	
American Aggregates, pfd.[47]	8-24-33	15	20	
American Aggregates 6's w.w.[47]	8-24-33	26	30	
American Aggregates 6's ex-w.[47]	8-24-33	20	28	
Amer. L. & S. 1st 7's[47]	8-24-33	48	55	
Arundel Corp., com.[47]	8-24-33	23 actual sale		50c qu. July 1, '33
Bessemer L. & C. Class A[47]	8-24-33	3	5	
Bessemer L. & C. 1st 6½'s[47]	8-24-33	15	17	
Bessemer L. & C. cert. of dep.[47]	8-24-33	15	17	
Bloomington Limestone 6's[47]	8-24-33	5	8	
Boston S. & G. new com.[37]	8-15-33	1	3	
Boston S. & G. new 7%, pfd.[37]	8-15-33	5	10	1.75 qu. Jan. 3, '33
Boston S. & G. 7's, 1934[19]	8-15-33	40	50	
California Art Tile, A[9]	8-18-33	1½	2	
California Art Tile, B[9]	8-18-33	½	....	
Calaveras Cement, com	8-17-33	2	6	
Calaveras Cement 7%, pfd	8-17-33	50½	....	1.75 qu. July 15, '33
Canada Cement, com	8-20-33	7½	8	
Canada Cement, pfd	8-20-33	36	37	
Canada Cement 5½'s, 1947[46]	8-25-33	72	....	
Canada Crushed Stone bonds[42]	8-16-33	70	....	
Canada Crushed Stone, com.[42]	8-16-33	3	....	
Certainteed Products, com	8-22-33	5	5¼	
Certainteed Products, pfd	8-22-33	20	25	
Certainteed Products 5½'s, 1948[46]	8-22-33	52¾ actual sale		
Cleveland Quarries	8-21-33	....	24	
Consol. Cement 1st 6½'s, A[47]	8-24-33	6	8	
Consol. Cement, pfd.[47]	8-24-33	1	2	
Consolidated Oka Sand and Gravel (Canada) 6½'s[12]	8-15-33	No market		
Consolidated Oka Sand and Gravel (Canada), pfd.[42]	8-15-33	No market		
Consol. Rock Prod., com.[47]	8-24-33	½	¾	
Consol. Rock Prod., pfd.[47]	8-24-33	¾	1	
Consol. Rock Products units[47]	8-24-33	1	2	
Consol. S. & G., pfd. (Can.)[12]	8-15-33	30	35	
Construction Mat., com.[47]	8-24-33	½	1	
Construction Mat., pfd.[47]	8-24-33	2	3	
Consumers Rock and Gravel, 1st Mtg. 6's, 1948[47]	8-24-33	20	25	
Coosa P. C. 1st 6's[47]	8-24-33	20	25	
Coplay Cem. Mfg., pfd.[47]	8-24-33	6	8	
Coplay Cem. Mfg. 6's, 1941[47]	8-24-33	48	52	
Dewey P. C., com.[47]	8-24-33	50	75	
Doiese and Shepard	8-23-33	8½	9½	
Dufferin Pav. & Cr. Stone, com.	8-15-33	1½ actual sale		
Dufferin Pav. & Cr. Stone, pfd.	8-15-33	25 actual sale		
Edison P. C., com.[47]	8-24-33	2	4	
Edison P. C., pfd.[47]	8-24-33	4	6	
Federal P. C. 6½'s, 1941[47]	8-24-33	27	32	
Giant P. C., com.[47]	8-24-33	2	4	
Giant P. C., pfd.[47]	8-24-33	10	15	
Gyp. Lime & Alabastine, Ltd.	8-20-33	4½	4¾	
Gyp. Lime & Alabastine 5½'s, 1948	8-15-33	45	49	
Hermitage Cement, com.[47]	8-24-33	10	15	
Hermitage Cement, pfd.[47]	8-24-33	40	50	
Ideal Cement 5's, 1943[47]	8-24-33	93	97	
Ideal Cement, com	8-24-33	25	28	25c qu. July 1, '33
Indiana Limestone 6's[47]	8-24-33	19	23	
International Cem. com	8-23-33	32½	33½	
International Cem. bonds, 5's	8-23-33	82¼ actual sale		Semi-ann. int.
Kelley Island L. & T.	8-23-33	8	14	25c qu. Jan. 2, '33
Ky. Cons. Stone, 6½'s, 1933	8-19-33	5	6	
Ky. Cons. Stone, com.[47]	8-24-33	....	½	
Kentucky Cons. Stone, pfd.	8-24-33	....	10	
Ky. Cons. Stone, 7% pfd.[47]	8-24-33	....	10	
Ky. Cons. Stone 1st Mtg. 6½'s[46]	8-25-33	8	....	
Ky. Cons. St. V. T. C.[47]	8-24-33	No market		
Ky. Rock Asphalt, com	8-19-33	2	2½	
Ky. Rock Asphalt, pfd.	8-19-33	11½	....	
Ky. Rock Asphalt 6½'s, 1935	8-19-33	53	55	
Kentucky Stone, com	8-19-33	....	¼	
Kentucky Stone, pfd	8-19-33	....	10	
Lawrence P. C.	8-18-33	19	22	
Lawrence P. C. 5½'s, 1942[47]	8-24-33	52	55	
Lehigh P. C., com	8-23-33	17	18¼	
Lehigh P. C., pfd	8-23-33	75⅞	78	87½c qu. Oct. 1, '33
Louisville Cement[47]	8-24-33	50	60	
Lyman-Richey 1st 6's, 1935[47]	8-24-33	80	85	
Marbelite Corp., com (cement products)	7-15-33	5c	½	
Marbelite Corp., pfd	7-15-33	¼	....	
Marquette Cement, com.[47]	8-24-33	6⅝	6¾	
Marquette Cement, pfd.[47]	8-24-33	50	53	1.50 qu. Jan. 3, '33
Marquette Cem. Mfg. 1st 5's, 1936[47]	8-24-33	65	70	
Marquette Cem. Mfg. 1st 6's, 1936[46]	8-22-33	62 (nominal)		
Material Service Corp.[47]	8-24-33	5	7	
McCrady-Rodgers, com.[47]	8-24-33	7	10	
McCrady-Rodgers 7%, pfd.[47]	8-24-26	35	40	
Medusa P. C., com.[47]	8-24-33	17	20	
Medusa P. C., pfd.[47]	8-24-33	35	40	
Michigan L. & C., com.[47]	8-24-33	60	65	
Missouri P. C.	8-23-33	8	9½	
Monarch Cement, com.[47]	8-24-33	50	60	
Monolith Portland Midwest[47]	8-24-33	½	1	
Monolith P. C., com.[47]	8-24-33	2	3	
Monolith P. C., pfd.[47]	8-24-33	3	5	
Monolith P. C., units[47]	8-24-33	4	7	
Monolith P. C. 1st Mtg. 6's[47]	8-24-33	60	65	
National Cem. (Can.) 1st 7's	7- 8-33	80 (nominal)		
National Gypsum A, com.	8-23-33	8¾	9¼	
National Gypsum, pfd.	8-23-33	63	66	1.75 qu. July 1, '33
National Gypsum 6's[47]	8-24-33	77	80	
National L. & S. 6½'s, 1941[47]	8-24-26	65	70	
Nazareth Cement, com.[47]	8-24-33	7	12	
Nazareth Cement, pfd.[47]	8-24-33	40	50	
Newaygo P. C. 1st 6½'s[47]	8-24-33	35	40	
New England Lime 6's, 1935[14]	8-16-33	No market		
N. Y. Trap Rock 1st 6's, 1946	8-18-33	64 actual sale		
N. Y. Trap Rock 7%, pfd.[47]	8-24-33	67 actual sale		1.75 qu. Jan. 3, '33
North Amer. Cem. 1st 6½'s[47]	8-24-33	20	24	
North Amer. Cem., com.[47]	8-24-33	1	2	
North Amer. Cem. 7%, pfd.[47]	8-24-33	2½	4½	
North Shore Mat. 1st 6's[47]	8-24-33	40	50	
Northwestern States P. C.[47]	8-24-33	31	34	
Ohio River S. & G., com.[47]	8-24-33	2	4	
Ohio River S. & G. 1st, pfd.[47]	8-24-33	35	40	
Ohio River S. & G. 2d, pfd.[47]	8-24-33	15	20	
Ohio River S. & G. 6's[47]	8-24-33	40	50	
Oregon P. C., com.[47]	8-24-33	10	12	
Oregon P. C., pfd.[47]	8-24-33	70	75	
Pacific Coast Aggr., com.[40]	8-18-33	5c	15c	
Pacific Coast Aggr. pfd.[40]	8-18-33	20c	40c	
Pacific Coast Aggr. 6½'s, 1944[5]	8-18-33	20	22	
Pacific Coast Aggr. 7's, 1939[5]	8-18-33	1	3	
Pacific Coast Cement 6's, 1937[47]	8-24-33	41	43	
Pacific P. C., com	8-17-33	6	10	
Pacific P. C., pfd	8-17-33	32	....	
Pacific P. C. 6's, 1935[47]	8-24-33	87	90	
Pacific Portland Cement 6½'s, pfd.[5]	8-18-33	32	....	1.62½ qu. Jan. 5, '33
Peerless Cement, com.[47]	8-24-33	¼	¾	
Peerless Cement, pfd.[47]	8-24-33	2	3	
Penn.-Dixie Cement, com	8-23-33	6½	6⅞	
Penn.-Dixie Cement, pfd	8-23-33	18	21	
Penn.-Dixie Cement 6's, A	8-22-33	72½ actual sale		
Penn. Glass Sand Corp., pfd.[47]	8-24-33	45	50	
Penn. Glass Sand Corp. 6's[47]	8-24-33	90	95	
Petoskey P. C., com	8-18-33	1½	2½	
Petoskey P. C. 6's, 1941[46]	8-22-33	40 actual sale		
Phosphate Mining Co. (N. Y.) com.	8-10-33	10 actual sale		
Port Stockton Cem., com.[9]	8-18-33	No market		
Republic P. C. 6's, 1943	6-27-33	49	52	
Riverside Cement, A[47]	8-24-33	5	6	
Riverside Cement, B[47]	8-24-33	2	3	
Riverside Cement, pfd.[47]	8-16-33	60	....	1.50 qu. Aug. 1, 33
Rockland and Rockport Lime, 1st, pfd.	7-20-33	2¼ actual sale		
Sandusky Cement 6's[47]	8-24-33	35	40	
Sandusky Cement 6½'s, 1932-37[47]	8-24-33	40	45	
Santa Cruz P. C., com.[47]	8-24-33	50	55	1.00 qu. July 1, '33
Schumacher Wallboard, com.[47]	8-24-33	1	2	
Schumacher Wallboard, pfd.[47]	8-24-33	3	5	
Signal Mt. P. C., pfd.[47]	8-24-33	10	15	
Southwestern P. C. units[47]	8-24-33	200	250	
Southwestern P. C., com.[47]	8-24-33	40	50	1.00 qu. Jan. 1, '33
Southwestern P. C., pfd.[47]	8-24-33	80	90	2.00 qu. Jan. 1, '33
Standard Paving & Mat. (Canada), com.[47]	8-24-33	2	5	
Standard Paving & Mat., pfd.[47]	8-24-33	45	50	
Superior P. C., A[47]	8-24-33	35	40	27½c mo. May 1, '33
Superior P. C., B[47]	8-24-33	9	11	
Trinity P. C. units[47]	8-24-33	25	30	
Trinity P. C., com.[47]	8-24-33	5	10	
Trinity P. C., pfd.[47]	8-24-33	20	25	
U. S. Gypsum, com	8-23-33	46½	48	25c qu. Oct. 2, '33
U. S. Gypsum, pfd	8-23-33	118¼	120	1.75 qu. Oct. 2, '33
Wabash P. C.[47]	8-24-33	5	6	
Warner Co., com[47]	8-24-33	3	5	
Warner Co. 1st 7%, pfd.[47]	8-24-33	20	25	
Warner Co. 6's, 1944, w.w.[47]	8-24-33	30	40	
Warner Co. 6's, 1944, ex-w.[47]	8-24-33	10	15	
Whitehall Cem. Mfg., com.[47]	8-24-33	10	12	
Whitehall Cem. Mfg., pfd.[47]	8-24-33	25	30	
Wiscon. L. & C. 1st 6's, '33[47]	8-24-33	70	90	
Wiscon. L. & C. 6½'s[47]	8-24-33	70	90	
Wolverine P. C., com.[47]	8-24-33	2	3	
Yosemite P. C., A, com.[47]	8-24-33	2	5	

Quotations by: [9]Smith, Camp & Riley, San Francisco, Calif. [9]A. E. White Co., San Francisco, Calif. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [14]First Wisconsin Co., Milwaukee, Wis. [19]Hewitt, Ladin & Co., New York, N. Y. [37]Wise, Hobbs & Arnold, Boston. [40]Martin Judge, Jr., and Co., San Francisco, Calif. [42]Nesbitt, Thompson & Co., Toronto. [46]First Union Trust & Savings Bank, Chicago, Ill. [47]Anderson Plotz and Co., Chicago, Ill.

United States Gypsum Co., Chicago, Ill., reports consolidated net income for the six months ended June 30 last was $831,541 after all charges and taxes, or equal after preferred dividends to 47 cents a share earned on the common stock. This compares with a net income of $963,789, or 57 cents a share, in the corresponding period of 1932.

A comparison of the consolidated statement for the six months ended June 30 follows:

	1933	1932
Operating profit	$ 1,521,506	$ 1,748,642
Other income	261,536	280,757
Total income	1,783,042	2,029,398
Income deductions	31,107	52,486
Depreciation and depletion	882,709	899,668
Income taxes	37,685	113,456
Net income	831,541	963,789
Preferred dividends	273,777	273,777
Common dividends	593,956	951,959
Deficit for period	36,192	261,947
Previous earned surplus	19,641,451	28,675,751
Credit adjustment exchange	15,980	*10,881
Reduced book value certain assets	.....	7,700,000
Profit and loss surplus	19,621,239	20,702,923

*Debit.

The company's consolidated balance sheet as of June 30 last shows current assets aggregated $19,063,660, including $13,218,665 in cash and United States government and municipal securities, as against current liabilities of $1,093,801. This compares with current assets of $18,605,926, including $13,412,329 in cash and securities, and current liabilities of $1,138,910 on Dec. 31, 1932.

Sewell L. Avery, president of the company, in his lettter to stockholders, stated: "The net income for the period reflects the low level of building activity that has been experienced in all lines. Demand for building materials was apparently at the lowest point during February and March. Since then, however, the improvement has been greater than seasonal. The company has accepted President Roosevelt's reemployment agreement and is now operating under its terms. It is also participating in the preparation of codes for submission to the president by the several industries of which it is a part."

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Alpha Portland Cement Co., Easton, Penn., reports for the 12 months ending June 30:

	1933	1932
Net sales	$3,955,671	$4,860,125
Operating expense	4,031,355	4,902,955
Depreciation	1,411,967	1,390,234
Operating loss	1,487,651	1,433,064
Operating income (net)	120,121	228,542
Loss	1,367,530	1,204,522
Minority interest (cr.)	11,733	11,073
Net loss	1,355,797	1,193,449
Preferred dividends	140,000	140,000
Common dividends	.....	533,250
Deficit for period	*1,495,797	1,866,699

*Before credit to surplus account of $68,600 profit on redemption of municipal securities written down as of December 31, 1931, and $165,550 restoration to lower of cost or market values as of December 31, 1932, of securities written down December 31, 1931, while company charged against this account $98,815 loss on sale of municipal securities.

Current assets	$7,720,929	$7,862,453
Current liabilities	283,919	335,801
Working capital	7,437,010	7,526,652

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North American Cement Corp., New York City, reports for 12 months ended June 30, 1933, net loss of $843.026 after taxes, depreciation, depletion, interest and amortization, comparing with net loss of $675,488 for the 12 months ended June 30, 1932.

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International Cement Corp., New York City, reports consolidated earnings:

3 months to June 30:	1933	1932
Gross sales	$3,446,587	$3,888,693
Costs and expense	2,379,532	3,246,736
Depreciation	737,093	691,235
Operating profit	329,962	(d)49,278
Interest, taxes, contingencies, etc.	402,262	300,250
Net loss	72,300	349,528
6 months to June 30:		
Gross sales	$5,943,559	$6,712,858
Costs and expense	4,188,978	5,724,523
Depreciation	1,268,101	1,158,205
Operating profit	486,480	(d)169,870
Interest, taxes, contingencies, etc.	739,637	589,371
Net loss:		
March quarter	$180,858	$409,713
June quarter	72,300	349,528
6 months	$253,158	$759,241

Quarterly Earnings, per share (in dollars):

	†1933	1932	1931	1930	1929
1st quarter	(d)0.29	(d)0.65	0.65	1.34	1.64
2nd quarter	(d)0.12	(d)0.56	0.93	1.91	1.86
6 months	(d)0.40	(d)1.21	1.58	3.25	3.50
3rd quarter	....	(d)0.83	0.84	2.20	2.20
9 months	....	(d)2.04	2.42	5.44	5.70
*4th quarter	....	(d)0.25	(d)0.16	1.70	2.20
12 months	....	(d)2.29	2.26	7.15	7.90

Number of shares, December 31: 1932, 626,278; 1931, 626,724; 1930, 635,798; 1929, 627,865.

*Obtained by deducting earnings for the first nine months from earnings for the full year.

†Based on 626,278 shares outstanding December 31, 1932.

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Material Service Corp., Chicago, Ill., sand, gravel and crushed stone producers, reports for the years ended December 31, sales and balance sheet as follows:

	1932	1931
Sales	$2,943,721	$5,648,315
Cost of sales including depreciation and Federal taxes	2,906,819	5,346,235
Net income	$ 36,902	$ 302,080
Earnings per share on 125,000 shares (no par)	$0.30	$2.41

Consolidated Balance Sheet December 31.

Assets—	1932	1931
Current assets	$1,327,053	$1,501,784
Fixed assets	2,024,374	2,544,230
Other assets	1,152,437	775,315
Good-will	1	1
Total	$4,503,866	$4,821,330
Liabilities—	**1932**	**1931**
Current liabilities	$ 769,272	$ 609,103
x-Capital stock	1,250,000	1,250,000
Capital surplus	866,833	1,049,029
Profit and loss surplus	1,422,761	1,407,364
Purchase money obligation	.....	39,500
Minority interest	25,000	25,000
6% notes	.....	341,333
First mortgage bonds	170,000	.....
Other notes payable	.....	100,000
Total	$4,503,865	$4,821,330

x-Represented by 125,000 shares of common stock, par $10.

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Construction Materials Corp., Chicago, Ill., sand and gravel producers, dredging contractor, reports consolidated net loss of $845,149 for 1932, against $174,337 net income in 1931. Before special charges consisting of provisions for losses in investment in common stock of Moulding-Brownell Corp., customers' and sundry account, and for contingencies aggregating $396,000, net loss was $449,149.

Net sales were $1,672,163 and gross profit on sales was $306,218.

Current assets as of December 31 aggregated $1,466,854, including $46,632 cash, and current liabilities were $1,078,634. This compares with $2,197,975 current assets, $208,224 cash and $968,435 current liabilities at close of 1931. Total assets were $9,756,611 against $10,618,161 a year earlier.

Comparison of consolidated balance sheet follows:

ASSETS

Current assets:	As of December 31, 1932	1931
Cash	$ 46,632	$208,224
Due from city of Chicago	864,542	959,271
Accounts and notes receivable	202,650	713,162
Cash value insurance	44,146	38,685
Inventories	308,884	278,633
Total current assets	$1,466,854	$2,197,975
Fixed assets	3,303,471	2,883,688
Vessels	3,470,306	3,491,606
Notes for completion of plant	30,311	408,090
Sand and gravel depreciation	779,538	790,332
Investment in subsidiaries	130,125	441,393
Goodwill	1	1
Deferred charges	49,308	97,676
Collateral demand notes	526,694	.....
Miscellaneous assets	.....	307,400
Total assets	$9,756,611	$10,618,161

LIABILITIES

Current liabilities:		
Notes payable	$628,731	$505,000
Accounts payable	302,529	330,750
Accruals	147,374	132,685
Total current liabilities	$1,088,634	$ 968,435
Notes and bonds	3,565,200	3,576,800
Reserve for contingencies	35,000	150,000
Preferred stock	3,375,000	3,375,000
Common stock	925,000	925,000
Capital surplus	777,777	.....
Profit and loss surplus	.....	1,622,926
Total liabilities	$9,756,611	$10,618,161

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Pennsylvania Glass Sand Corp., Lewiston, Penn., reports balance sheet as of December 31 as follows:

ASSETS

	1932	1931
Property, plant, etc.	$13,698,805	$13,637,990
Current assets:		
Cash	165,384	231,109
Accounts and notes receivable	390,507	434,937
Inventories	111,785	121,503
Securities	424,190	424,190
Deferred accounts	298,250	333,111
Sinking fund	66,867	64,072
Total	$15,155,788	$15,246,912

LIABILITIES

†Capital and capital surplus	$8,669,603	$8,669,878
First 6s, 1952	4,458,000	4,580,000
Current liabilities:		
Accounts payable	228,545	194,506
Accrued accounts	17,859	18,865
Interest and dividends payable	*133,740	181,584
Reserves	754,346	615,224
Earned surplus	893,696	986,855
Total	$15,155,788	$15,246,912
Current assets	$ 1,091,866	$ 1,211,739
Current liabilities	380,144	394,955
Working capital	711,722	816,784

*Bond interest accrued.

†Represented by 28,814 (28,834 in 1931) $7 preferred and 300,000 common no par shares.

No dividends on common stock have been paid since 1925; the most recent dividend on preferred stock was paid April 1, 1932.

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Pennsylvania-Dixie Cement Corp., New York City, reports for the 12 months ending June 30:

	1933	1932
Gross profit	$ 371,197	$ 350,902
Depreciation and depletion	1,378,764	1,385,823
Loss	1,007,567	1,034,921
Interest	580,751	608,219
Net loss	1,588,318	1,643,140
Current assets	$4,775,225	$5,446,660
Current liabilities	326,196	409,555
Working capital	4,449,029	5,037,105

Yosemite Portland Cement Corp., San Francisco, Calif., reports total sales in 1932 declined 36% compared with 1931. The average sales price was approximately $1.61 per bbl., a decrease of 8c. Production cost increased 3% over 1931 because of fixed charges and lower volume. Total sales and administrative expenses were decreased 9%. Laboratory work in the development of special cements was continued, and special effort was placed on improving production processing. Improvements in the kiln department increased its efficiency.

Surplus at the end of the year amounted to $262,472, a decrease of $24,910, compared with 1931. Current assets were $645,715, of which $279,644 was cash and marketable securities. Current liabilities amounted to $27,292.

Balance sheet, as of December 31, 1932, is as follows:

ASSETS

Plant properties	$1,873,376.14	
Less reserves for depreciation and depletion	399,131.20	
Remainder		$1,474,244.94
Investments, at cost		89,621.38
Current assets:		
Cash	$ 56,248.00	
Marketable securities	223,396.01	
Accounts receivable	$128,553.19	
Notes receivable	66,502.70	
Total	$195,055.89	
Less reserve for doubtful accounts and notes	9,447.56	
	185,608.33	
Inventories (based on physical inventories and book values; not verified as to quantities)	180,463.10	
Total current assets		645,715.44
Intangible assets acquired with entire issue of class B common capital stock, and organization expenses		1,743,896.58
Deferred charges		65,399.32
Total		$4,018,877.66

LIABILITIES

Capital stock:		
Class A 8% cumulative and participating common capital stock (authorized 250,000 shares of $10 each; issued, 234,790 shares, less in treasury, 3,669 shares; outstanding, 231,121 shares)	$2,311,210.00	
Class B common capital stock (authorized, 150,000 shares of $10 each; outstanding, 140,800 shares)	1,408,000.00	
Total capital stock		$3,719,210.00
Mortgages payable		9,504.11
Current liabilities:		
Accounts payable	$25,321.74	
Customers' sack redemption account	1,970.10	
Total current liabilities		27,291.84
Surplus		262,471.71
Total		$4,018,877.66

No dividends have ever been paid Class A or Class B common stock.

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Peerless Cement Corp., Detroit, Mich., which is in receivership, sold its plant at Union City, Mich., free of all liens and incumbrances, subject to court confirmation, to Morris Birnbaum, Wyandotte, Mich., for $16,850 cash.

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Gypsum, Lime and Alabastine, Canada, Ltd., Paris, Ont., reports for the years ending December 31:

	1932	1931
Net profits for year	$ 96,453	$551,605
Interest on funded debt	258,390	247,581
Interest on bank loan	.....	.....
Depreciation	25,173	195,913
Depletion	.....	13,473
Losses by subsidiaries	39,691	.....
Net profit	def.$226,802	$ 94,637
Surplus January 1	57,935	244,094
Total surplus	def.$168,867	$338,731
Dividends paid	.....	225,396
Provision for Dominion income tax	.....	4,500
Miscellaneous charges	.....	.....
Provision for possible loss in foreign exchange and bad debt and doubtful accounts	68,769	50,900
Surplus, December 31	def.$237,635	$ 57,936
Earnings per share on 450,876 shares common stock outstanding (no par)	Nil	$0.21

Consolidated Balance Sheet December 31

ASSETS

	1932	1931
Cash	$ 18,740	$ 86,425
Receivables	376,360	538,243
Advances	.....	60,978
Investments	35,025	35,025
Bonds purchased	11,059	99,596
Inventories	567,956	769,873
Trustee account re employees' stock	225,441	.....
Due from subscribers on shares of above	975	.....
Life insurance	25,403	21,773
Land, plants, etc.	5,973,817	5,932,037
Mines, etc.	3,814,018	3,829,939
Investments in and advances to subsidiaries	130,935	133,687
Sundry assets	60,399	60,387
Deferred charges	87,233	79,328
Bonds, debenture discount, etc.	301,349	314,824
Total	$11,628,713	$11,962,117

LIABILITIES

	1932	1931
Accounts payable	$116,195	$194,670
Accrued interest	79,978	83,381
Tax reserve	1,040	.....
Contingent reserve	14,085	15,790
*Common stock	6,183,393	6,183,393
Surplus	def.237,635	57,935
Bonds	4,190,373	4,338,843
Mortgages payable	55,200	68,600
Deferred liabilities	21,600	25,290
Bank loans	232,269	35,000
Reserves	972,214	959,213
Total	$11,628,713	$11,962,117

*Represented by 450,876 no par shares.

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Recent Dividends Announced

Lehigh Portland Cement pfd. accum. (qu.)	$0.87½	Oct. 1
U. S. Gypsum, com. (qu.)	.25	Oct. 2
U. S. Gypsum, pfd. (qu.)	1.75	Oct. 2

Cement Production—July

THE portland cement industry in July, 1933, produced 8,609,000 bbl., shipped 8,697,000 bbl. from the mills, and had in stock at the end of the month 19,848,000 bbl. Production of portland cement in July, 1933, showed an increase of 12.4% and shipments a decrease of 5.7%, as compared with July, 1932. Portland cement stocks at mills were 11.8% lower than a year ago. The mill value of the shipments—27,927,000 bbl.—in the first half of 1933 is estimated as $35,270,000.

The statistics here given are compiled from reports for July, received by the Bureau of Mines, from all manufacturing plants except three, for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 164 plants at the close of July, 1933, and of 165 plants at the close of July, 1932.

RATIO (PER CENT) OF PRODUCTION TO CAPACITY

	—July—		June	May	April
	1932	1933	1933	1933	1933
The month	33.4	37.6	35.2	27.4	18.9
The 12 months ended	34.2	26.3	26.0	26.0	26.2

Portland Cement Yardage

AWARDS of concrete pavement for July and for the first seven months of 1933 are announced by the Portland Cement Association as follows:

	Sq. yd. awarded during July, 1933	Sq. yd. awarded to date, July 29, 1933
Roads	878,787	12,324,584
Streets	513,328	1,839,064
Alleys	35,578	120,008
Total	1,427,693	14,283,656

"Mike" Eiben Goes Through Cuban "Revolution"

MR. EDITOR: Just to pass along to you that I am again back in the dear old U. S. after having quite an experience in the past five weeks. I went to Cuba and got caught in the revolution at Santiago. Being down there with my car, I had to drive 600 miles through war-torn Cuba, and what a time I had!

One advantage was that the soldiers treated us very nicely and would get gasoline for us at the various cities. Otherwise I would not have been able to get through. When we got to Havana we were right in the midst of it. Picture me living one week on crackers and beans!

However, we finally got out and now I am back here on the job, and brought back the largest dust collecting order we have ever had, for the Cuban-American Manganese Corporation. You will probably remember our old friend, Lindley C. Morton, who built the Phoenix cement plant at Birmingham. He is now interested in this manganese plant, and we are going to do an honest-to-goodness job.

It is a standard steam shovel mining operation with narrow-gauge railroad to the crusher house, and at the crusher house they have a Traylor 54x48-in. jaw crusher. Then this material is fed on an inclined belt up to a Symons crusher, then a Marcy ball mill grinds it into fines and from this point on, it is standard mining practice of flotation. After the materials are separated, it is put on a sinter bed of Dwight Lloyd Co., which makes the manganese sinter.

M. A. EIBEN, President,
The Northern Blower Co.

Cleveland, Ohio,
August 24.

Rock Products News Briefs

Lime

Gibsonburg Lime Products Co., Gibsonburg, Ohio, has reopened its plant after being shut down since December, 1932.

Bruns Hydrated Lime Co., Woodville, Ohio, which has been in receivership for more than two years, has been sold to Wolfe and Rogers, attorneys, Toledo, Ohio, acting for the recently organized Sandusky Lime Products Co. (see ROCK PRODUCTS, May 25, 1933, p. 36). The price paid was $35,000; the plant was once appraised at considerably more than $100,000.

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Wisconsin lime manufacturers have published the report of Prof. George J. Barker, of Wisconsin State University, as a result of his 3-year study of Wisconsin dolomitic limes. Eighteen manufacturers contributed to the investigation. The *Madison Capitol Times* recently stated: "The investigations were undertaken as a result of keen competition from producers of calcium limes, patent mortars, and other similar products which have made definite information about Wisconsin limes a matter of serious concern to state producers. Controversy over the comparative qualities of magnesium and calcium limes has arisen mainly in the building industry, in which field the Wisconsin lime competes with those produced in other states. Results of Prof. Barker's researches completely upset old beliefs as to better qualities of limes. It is expected that his results will be of great aid to the state producers who have backed his researches. Prof. Barker also has shown by his tests that certain patent mortars, often used in building, develop high strengths only under wet weather conditions."

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Alabaster Lime Co., Siluria, Ala., announces its formal opening. The company has operated a crushed-stone plant for a number of years under the name of the Alabaster Stone Co. George L. Scott, Sr., is manager.

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Holmes Lime and Cement Co., San Francisco, Calif., announces that years of experimentation and the development of new equipment are behind the Holmes "Diamond" finishing hydrate now being marketed. "Diamond" finishing hydrate supplies a long-felt want in the building industry," asserts Raymond J. Schirm, manager; "it combines all the proven qualities of a high calcium lime for strength and durability with super-plastic features only achieved through long years of experimenting and installation of new equipment, revolutionizing manufacturing processes."

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France Lime Products Co., Gibsonburg, Ohio, has been sold to a Toledo, Ohio, syndicate. This plant was originally built and owned by the late W. L. Urschel, and was known as the W. L. Urschel Lime and Stone Co. At about the same time a 30-day option was taken on the Bruns Hydrated Lime Co., Woodville, Ohio, which is in receivership. The purchaser of the Gibsonburg plant was announced as the newly incorporated Sandusky Lime Products Co., Toledo (see ROCK PRODUCTS, May 25, p. 36). It is presumed that the same company secured the option on the Woodville plant.

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Phosphate

Tennessee: A special correspondent reports: Business conduct in all ordinary lines is enlisting practically 100% under such N. R. A. regulations and codes as have been definitely decided upon, or under President Roosevelt's blanket agreements. Such phosphate producers as have signed any agreement at all, so far as known have simply signed the President's agreement, and are awaiting final action on the code of the National Fertilizer Association, to which all of the large producers belong, all but one of them being branches of fertilizer companies. If phosphate rock mining is finally placed unreservedly under the fertilizer code, it will mean final completion of the destruction of phosphate rock mining and preparation as a separate industry which has been under way for over twenty years.

Under the prices that have been paid for a very small tonnage of rock produced during the past eighteen months, it has been impossible for labor to make over five or six dollars per week, and many have been unable to get work at all, so didn't even make that. It is obvious that for the decent wages of the code to apply, consumers of rock will have to pay more money for it, and everyone is waiting to see just how such price increases can or will be brought about, as long as most producers are consumers who have driven most small producers out of business.

The one easy way would be development of some part at least of the enormous potential consumption of ground phosphate rock by farmers who do not now use any fertilizer at all, and who by its use under a properly planned agriculture, would actually decrease the total production of those crops whose surplus has been so detrimental, and yet so greatly increase production per acre, as to reduce costs to where profit might be had even at low prices. A pitifully few phosphate rock producers have attempted to develop this consumption, but the combined force of the fertilizer industry has so far prevented that being done, and the same industry has at the same time mined phosphate rock and sold their surplus to non-mining competitors at prices below independent cost of production. Whether this will continue long under the new deal is not now known, but it may easily be predicted that some change will occur, or else the sad sight of the poor phosphate miner still looking for work at from 75c to $1.25 for ten hours, while countless thousands of farms in the Mississippi Valley go hungry for phosphate, will constitute a most deplorable exception.

In all probability delay on final adoption of the Fertilizer Association code is causing hesitation to purchase raw material, and so far no effort has ostensibly been made to stimulate the farmer market, as is natural when such great efforts are being made to decrease production.

Some representatives of the phosphate mining branches of fertilizer companies, with one or possibly more of the large independent miners have been working for some time on a phosphate mining code, in New York, but so far as learned no small independent miner in this field has ever been consulted or even favored with a draft of the provisions being considered.

One of the small hand miners has recently opened up a new mine on Rutherford Creek, and is getting a nice lot of very high grade rock ready for shipment, analysis of the first kiln having just been seen by the writer as follows: B.P.I. 80.32% (phosphoric acid 36.76%), alumina 1.10%, iron oxide, 2.55%. Such rock in former times sold for $18 per ton, but would be sold now for around $5, unless labor costs become prohibitive.

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Mineral Aggregate Code Hearing August 28

AS this issue of ROCK PRODUCTS goes to press the editor is leaving for Washington, D. C., where the long awaited public hearing on the code of fair competition of the three mineral aggregate industries is scheduled to be held, August 28. Malcom Muir, the deputy administrator who conducted the hearing of the lime industry, will be in charge.

Prior to the public hearing there is to be a two-day meeting of the industries to hear suggestions and complaints before the code is officially submitted. Some changes required by the National Recovery Administration have already been made in the code as adopted by the industry at Chicago in July. It was necessary to strike out the provisions designed to prevent competition from government bodies, because the NRA held that these industries could not legislate for the Federal Government, the several states, or any political divisions of them. It is expected, however, to keep up the fight against publicly-owned and operated plants.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Rock Products Possibilities in the Small House Market

By Edmund Shaw

Contributing Editor, Rock Products

READERS of ROCK PRODUCTS are producers of materials, not builders, but their fate today is largely in the hands of the builders. There is no longer a problem of producing enough to supply the market at a reasonable cost, the producers' problem is how to sell production. At such a time every effort is necessary not only to find new markets *but to hold the market that we have*. For there is a real danger that we may lose a considerable portion of our present market to other materials, some of them so new that they were not heard of a year or two ago.

That portion of our market is in the building of residences, garages and small commercial buildings. We have been so interested in building big things, dams, highways, hotels, big office buildings and apartment houses that we have forgotten that a great deal of our materials may go into the smaller structures. A recent government report estimates that we are short about 500,000 one-family homes. Another estimate, published in the March issue of ROCK PRODUCTS (p. 48) shows a shortage of 450,000. Whatever the exact figure, it is certain that the shortage is sufficient to start the building of many homes with any real improvement in business, and it will go on at an increasing tempo.

The producers of other building materials understand this very well and are preparing for the business by advertising and educating the public to the advantages of their materials. In the past six months many stories have appeared in the building and home magazines showing that good and reasonably inexpensive homes may be made from pressed steel, enameled ware, reinforced brick, glass, such new materials as "rostone" and a number of fiber products, which have trade names like "masonite" and "prestwood." Some of these are being promoted by companies with ample capital to buy pages of advertising space in the best newspapers and the big weeklies, and to show their products in the Century of Progress and other expositions. High priced publicity experts not only catch the buyers' attention but make buying easy. You can buy a pressed steel house or filling station from a catalog and buy a ready-cut frame house through a mail-order company. Brick makers will pour out information if they hear anyone whisper that you think of building. And the producers of the newer materials need only a postcard to deluge you with literature.

The Portland Cement Association does the same thing for concrete building units and does it well. Its publications are in fact models for the presentation of such a subject. But other methods of small house concrete construction are not covered at all. There is almost nothing to be learned of small house construction in some other rock products. Gypsum products seem to the writer to be especially adapted to small house and garage construction, but he has not been able to find much in the way of literature to show him how gypsum products have been—or might be—used. Sand-lime brick is sufficiently standardized so that close estimates of cost may be made and all it needs is more intensive advertising. Among themselves these materials are competitive, but they are all members of the rock products family and it seems to the writer that they might well combine against the encroachment of such materials as enameled ware, which does not seem to him to be suitable for a house, however valuable it is in the kitchen.

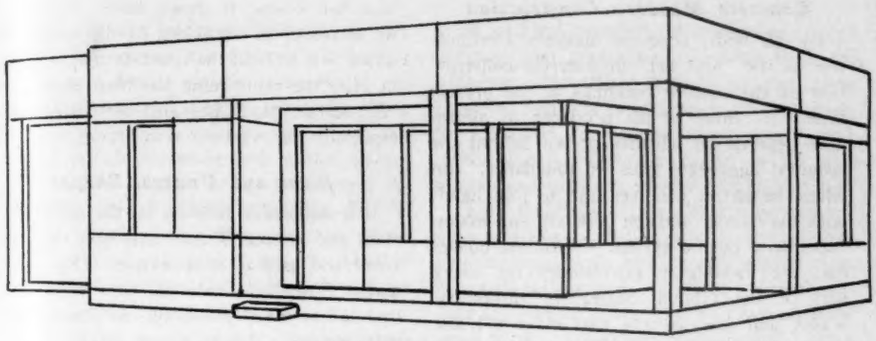
Another thing that the industry should do is to understand thoroughly that a new style of architecture has come (they call it the International style) and the new buildings to be put up with the revival of home building, very many of them will be of that style. The newer designs differ radically from any that have been built before in sufficient numbers to make a style. Mainly they are long and low, flat roofed, free of ornament and with long rows of windows separated only by steel members. Roofs are being utilized as gardens or resting places, which means a durable as well as a strong roof. The wide openings for long rows of windows demand unusual beam strength. But the coming of a new style need not worry rock products producers for both in the United States and Europe new style buildings have been put up of concrete block and reinforced concrete, and concrete slabs and concrete frame with filler. In fact it would seem that the International style is better adapted to construction in rock products than in some other materials.

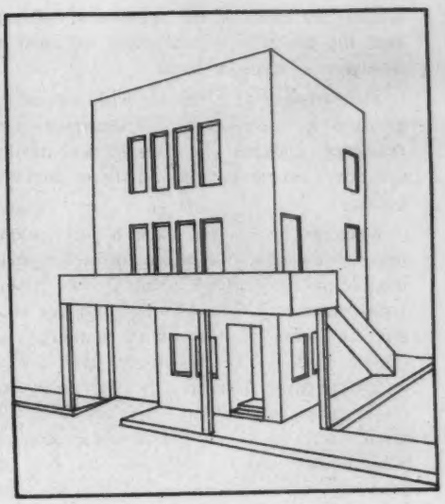
Small Buildings of Monolithic Concrete

Monolithic construction was the first used for making concrete residences. Thomas A. Edison tried it years ago and succeeded in pouring a house, complete with the wires and plumbing in place in 24 hours. Somewhat later such houses had quite a vogue here and in Europe. But concrete was found to be a better conductor of heat than it had been thought to be and this made such houses difficult to live in. So monolithic concrete was more or less abandoned for concrete masonry, with its insulating air spaces.

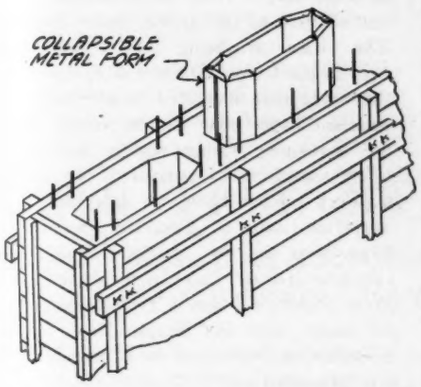
In more recent times the problem of making a monolithic house that would resist heat and cold sufficiently has been solved in at least three ways. On the Pacific Coast a company has developed a method of forming a wall with collapsible metal forms that make air spaces like those in a concrete building block. The exterior forms are of wood as in any ordinary monolithic job. Important public and private buildings, libraries, museums, restorations of old missions and so on, have been built by this method. Recently a group of comparatively small residences, to be used as officers' quarters, was put up at March Field, Riverside, Calif., a military airport. It is the opinion of a good concrete engineer, familiar with all the usual methods of concrete construction, that this method is well adapted to small building construction, and best adapted to group construction by companies which have capital to maintain an organization and the necessary equipment. The designs need not all be the same, however, as they must be for success with some other methods of group construction.

A second method of obtaining insulation is to make porous concrete. This is made in





European type of house and garage designed to be built of large precast units of concrete. Right—A German type of monolithic construction erected with sliding forms



Monolithic construction with large air cells

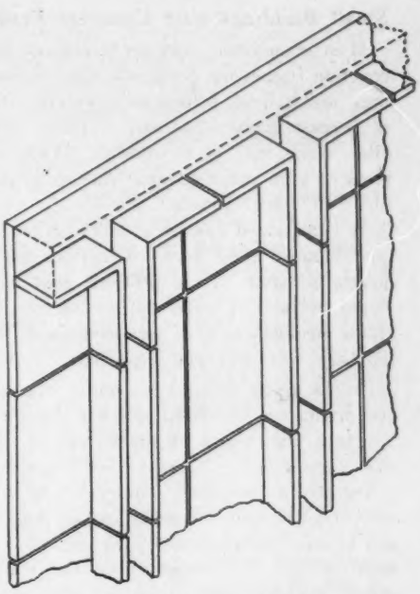
two or three different ways, the best known, probably, being by the use of aluminum or zinc powder in the mix. A very little of this is enough to make gas bubbles which will swell the volume at least one-third, as bread rises with yeast. Such concrete has had a considerable use in Europe but not much in the United States. It is adapted to making blocks and slabs rather than to make monolithic concrete houses, according to those who have studied it.

But it is possible to make a porous concrete very simply by leaving out the fine aggregate from the mix. The pieces of coarse aggregate will be held together in a mass-like "cracker-jack." The size and number of the voids will of course vary with the size of the pieces of aggregate and the percentage of voids will vary with the grading. Pieces all of one size would give the greatest percentage of voids.

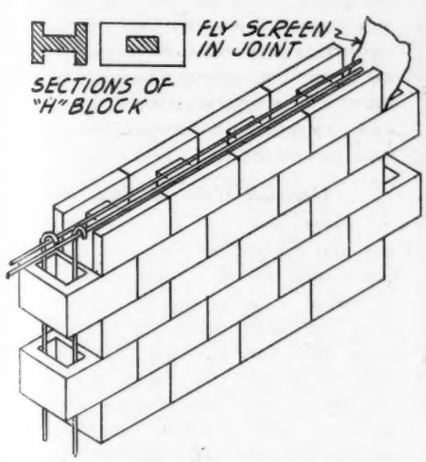
Residences have been constructed of this material in the suburbs of Los Angeles. Since the material has low flexural and tensile strengths it must be combined with a frame of wood, steel (like the sheet metal standardized steel lumber) or concrete. The writer has been told by one who has studied this construction that the porous concrete is satisfactory as an insulator and as a backing for the stucco coating given it within and without.

Porous Aggregates and Concrete

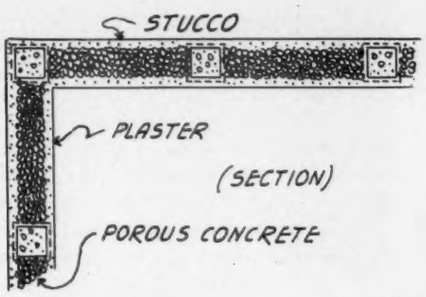
Porous aggregates have long been used in fireproofing concrete and will serve to make concrete a better insulator. One authority says that "haydite" concrete has only about one-third the conductivity of ordinary concrete. Cinders, coke breeze, the fines left in coke burning, crushed brick and so on have all had some use in this country and a much greater use in Europe. "Metallized" sawdust, rice hulls and other organic matter have been tried. Recently sawdust coated with gypsum has been introduced on the Pacific Coast. The inventor claims that the gypsum neu-



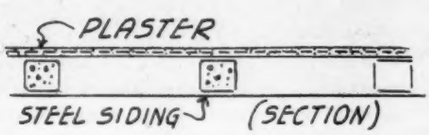
Slab construction with provision to make forms for beams and studding



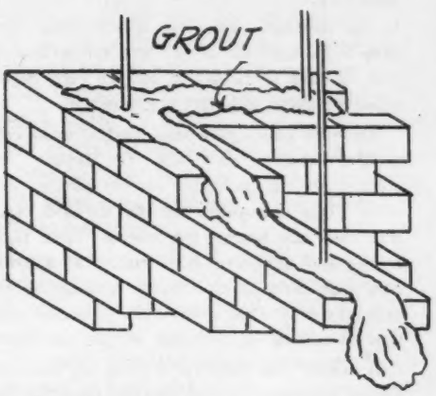
Belt course of "H" block and reinforcing steel



Concrete frame with porous concrete filling



Steel tubes filled with concrete used as a frame



Special brick walls with concrete filling

tralizes the effect of the tannic acid and says that the concrete is practically as good an insulator as gypsum block.

The strength of concretes with porous aggregates is sufficient for the construction of residences and the like. Cinder and haydite concrete are acceptable to most building codes.

Attempts have been made to save something of the cost of erecting forms for small monolithic structures. Sliding or rising forms have long been used not only for silos but for some of the simple buildings of cement mills. The use might have spread to apartment houses and the like if it had not been opposed by real estate interests who did not want to see cheaper buildings erected because they might lower rents on existing property—which usually was heavily bonded. This opposition probably would not be felt so strongly now. The Van Guilder system of rising forms was developed several years ago and many houses were built by it in different parts of the country. Recently there has been some revival of interest in it.

Small Buildings with Concrete Frames

Most monolithic concrete buildings have concrete frames but there is a class of buildings which have frames of concrete, either of precast numbers or cast in place, and a filler which may be of concrete, brick, tile, block or some other material such as gypsum tile. In some parts of the Pacific Coast there is an added interest in buildings of this type because they have withstood earthquakes so well. It is probable that more would be built if codes did not require the frame members to be of such dimensions that they are overheavy and expensive.

Precast joists are now a regular commercial product, as described in Rock Products for June, and beams of lintels and the like have been sold for years in some localities.

Recently a steel-clad, concrete-frame construction has been introduced in Los Angeles and at least one good-sized building has been built of it. The members of the frame, plates, studding and so on are steel tubes filled with concrete, the studding being set in a concrete foundation. It is difficult to see why this steel clad member is any better structurally than one of concrete reinforced in the ordinary way. In the building mentioned the exterior is of steel siding and the cost is said to be about 15 per cent higher than the usual masonry construction.

Recently gunite has been used to make concrete frames, not only to repair and strengthen old buildings but to put up new ones. The promoters of the method claim that they can put up the simple "open face" forms and fill them with gunite at a lower cost than pouring the frame in place in the ordinary way and at an even less cost than that of setting up a frame of pre-cast units.

It seems that there is a field for concrete frame buildings of the smaller type but the methods of construction need study so that the best may be settled upon.

Concrete Masonry Construction

By all odds, concrete masonry construction is the "best bet" in concrete construction of the smaller buildings at the present time. Its value to the producer of aggregate depends on whether or not he has the required aggregate sizes in abundance. But where he has it will pay him to join hands with the builder and the concrete unit manufacturer to push a system of building houses that are thoroughly satisfactory for every part of the United States in durability, beauty and the qualities that make a house comfortable to live in. And the intending home builder can get ample information as to cost as well as every detail of construction.

"Low Cost Fireproof Concrete Homes," issued by the Portland Cement Association, gives plans and perspectives of 14 typical homes costing from $2,700 to $6,600, figures which may vary 25 per cent either way from differences in local conditions. Six of these are in the modern (International) style and show that concrete masonry, including precast lintels and so on, is thoroughly adapted to that style. The example shown here costs only $3,100, and it has walls of exposed concrete masonry and floors and roofs of reinforced concrete. The roof may be used for recreation. Other designs, in which the modern note is even more emphasized, may be built for $2,850 to $4,200.

In the colder parts of the United States it has been usual to stucco the exterior of concrete masonry buildings. In the south and southwest exposed masonry is more popular. One of the things that has made exposed masonry practical where there is much rainfall is the development of portland cement paints that are really waterproof. In the Los Angeles area concrete block are hardly known to the public, the demand being for tile that measure 12x3½ ins. on the face exposed. These are brush-coated or treated in some way that will bring out the texture of the concrete. Most of these tile are wet-cast of a mix that is less pervious to moisture than most dry tamped blocks. There is a considerable use of such tile for veneer on wood frame buildings, and the code permits this if the tile are tied to the frame every third course with a certain wire tie. Practically everything that it is needful to know about concrete masonry as a building material may be found in the many bulletins issued by the Portland Cement Association.

Recent improvements in the concrete masonry industry have largely been in perfecting the method of manufacture to reduce production costs. Mechanical handling has superceded hand labor and the process has been better organized. Reductions of as much as 25 per cent have been possible in some parts of the country.

Many codes on the Pacific Coast require masonry to be reinforced and this has led to some improvements in the shapes of concrete building units to permit easy placing of reinforcement and grout. One becoming quite well known is the "H" block. Its use in a belt course is shown here. A strip of fly screen cloth the width of the wall is put down first to hold the concrete that is poured in after the reinforcing has been placed. An "E" section block has also been used, more especially for vertical reinforcing.

Slabs and Unusual Shapes

It is impossible to even list the varieties of slabs and unusual shapes that have been patented and used to some extent. They are so many. The slabs vary in sizes from those that can be easily placed by one man to those that require a heavy power crane to place them. Unusual shapes include very large sections of complete houses and some odd shapes of blocks, generally made to interlock in some way. These have practically gone out of use, so far as the writer can learn. The former are being used to some extent both in the United States and Europe, where they were first developed commercially. The smaller shapes that can be easily handled are developing rather rapidly and promise to be something of a rival to the standard masonry units. Both are described in the May-June issue of *Concrete Products,* the large units in the article, "Prefabricated Concrete Homes" (also in the June issue of Rock Products) and a typical example of the small units in "Simple New Type of Construction Developed by Concrete Products Manufacturer."

Recently representatives of European companies that have successfully used such methods abroad have come to this country to introduce the use of slabs and house sections of patented design. An attempt was made to use large concrete slabs in one of the most modern designs shown at the Century of Progress exhibition, at Chicago, but they were found impractical. Regarding these large slabs and sections, R. E. Copeland, of the Portland Cement Association, says in one of the articles mentioned that it will be many years before a satisfactory factory-made house will be available, and that he thinks we will likely find that there are better solutions to the housing problem than the pre-fabricated house. So does the present writer.

A feature of most slab and sectional methods is that projections on the slab shall serve as forms for casting ribs or studding or beams. The diagram shows how the principle is applied. It does not show any special form of block.

Unusual Uses of Concrete

Concrete walls with brick veneer are common and this possibly suggested the combination shown, known as "groutlock." Bricks, of special shape to grip the concrete, form outer and inner walls, the space between being filled with concrete. Houses of this combination are now being built in Los Angeles. A more logical combination would be a thin slab of precast concrete for the exterior and some insulating material for the interior.

The most radical departure from accepted

methods is found in the Garrett system, just recently introduced in southern California. This uses a double wall of concrete or cement mortar on wire mesh, the walls being held apart by light sheet metal braces, the ends of which are embedded in the mortar of the walls. There is no frame and no foundation and the cost is so low that it competes readily with the stucco-on-frame which is almost standard for the smaller buildings of southern California. It will be fully described in a later issue.

It is plain to the writer that concrete ought not to be afraid of competition from any of the proposed new materials for small buildings on economic grounds. Whatever it loses it will lose because of the failure of its promoters to properly educate the public to its advantages.

The excellent work of the Portland Cement Association for concrete masonry should be supplemented everywhere by the work of local associations, producers of aggregates and contractors for this form of building. No other branch of the rock products industry is in such a good position to withstand competition from newer materials, but it will not do to let up on promotion and publicity on that account.

Small buildings of monolithic concrete are quite practical, but they can better be built by companies with considerable capital than by small contractors. Concrete-frame buildings are excellent in every way but methods need to be studied and standardized. Both precast and gunite frames should be successful economically.

The greatest obstacle at present to advance in small building concrete construction is the patent situation. Everywhere one turns there is a patent that may bar the way to improvement. Most of the owners of these patents have received nothing from them and never will.

Preframed creosoted timber tower supporting cables carrying buckets on rocking saddles. Note traction rope rollers

Aerial Tram for Crushed Stone

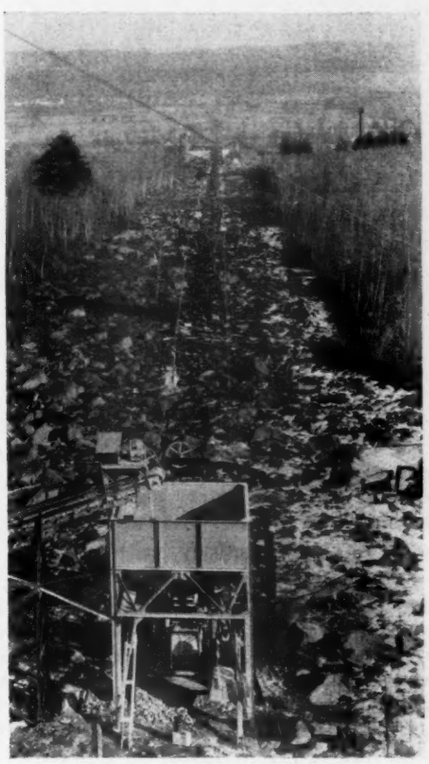
Operating Cost Over 2,500-Foot Route Put at Two Cents a Ton Exclusive of Insurance and Amortization

DEVELOPMENT of an aerial tramway for carrying crushed stone from a quarry company's waste pile to a railroad siding, has solved a difficult short-haul problem on a large eastern project. Although the cost was substantial, $17,300 exclusive of the concrete foundations, anchorages and terminal bins required, results have been satisfactory, according to the operators of this industrial "skyride."

At the receiving end, a timber derrick with 100-ft. mast and boom, is operated by a 2-drum electric hoist and swinger. Rock of varying size is loaded into steel skips by hand. The derrick is above the rock pile and handles the skips to a hopper which reloads the stone into an 80-cu. ft. Insley incline car. A single drum semi-automatic Novo electric hoist lowers the car on a slope of about 20°, and the load discharges automatically on a steel rail lined chute from which it flows to a 24 by 36-in. jaw crusher. The discharge from the crusher is dust to 5-in. size. It falls directly on an 18-in. conveyor belt which carries it 120 feet to a 75-ton Iowa Mfg. Co. steel hopper bottom bin.

An American Steel and Wire Co. bicable tramway conveys stone at the rate of 75 tons hourly to the discharge terminal about 2500 feet away from the loading bin. Tramway buckets discharge into a 100-ton timber bin and the stone is then carried on a 24-in. belt conveyor 108 feet long to a Robbins vibrating screen. All material under 2-in. is discharged into a bucket elevator. The balance is run through a Kennedy 10-in. gyratory crusher, the discharge from which goes to the same bucket elevator as used for the screened stone. This elevator raises all the stone to a vibrating screen where it is classified, each size being spouted to its proper bin compartment.

A railroad siding, with provision for eight cars, runs under the bin. Gates in the bottom of this bin provide for loading railroad cars directly. A reversible belt conveyor running under the bin also provides for loading trucks at one end and for transferring stone to a stacking-out conveyor at the other end. One side of the bin is fitted with outlet gates for possible future use.



General view of tramway from loading terminal showing five intermediate towers and discharge terminal in distance

Sixteen buckets of 20 cu. ft. capacity are slung on the tramway cables. They are rotary self-dumping type, supported in hangers built up of steel angles and suspended from the overhead type of grip carriage. This carriage has two 10-in. tread diameter wheels fitted with tapered roller bearings. The grip jaws project above the top of the carriage housing and gripping pressure is developed through toggle levers.

The loaded buckets travel on 1½-in. diameter track cable, and the empty buckets on ⅞-in. cable, both cables being of locked coil construction. Cables are anchored in both terminals. The traction rope is ⅝-in. 6 by 7 Lang lay construction, running at 400 ft. per minute. Buckets are sent out at intervals of 48 seconds or spacing of 320 ft. The American Steel and Wire Co. furnished all material and performed all erection work exclusive of foundations and anchorages.

All structures are of timber, preframed and pressure creosoted before delivery on the job. This feature is an innovation in tramway work. A minimum of six lb. of oil per cu. ft. of timber was specified and the timber did not bleed excessively, although it was necessary to protect the workmen's hands during erection.

At the loading terminal it was necessary to burn out part of the bottom of the Iowa steel bin and attach an extension which formed a support for the circular, undercut bin gate. Buckets detach automatically, are loaded by hand and attach automatically when an electrically operated gong gives the operator the signal to send the load out.

The signal bell switch is operated by a

small worm gear driven from a guide sheave shaft. The traction rope is driven by a grip sheave four feet in diameter. It is mounted on the slow speed shaft of a Westinghouse double reduction speed reducer which is connected by a flexible coupling to a Westinghouse type CW, 1700 r.p.m. slip ring motor with motor-mounted brake. Both motor and reducer are mounted on a welded steel base. The grip sheave runs in a galvanized sheet steel tank which is partly filled with oil. This serves as a combined traction rope and grip jaw oiler, also a safety guard for the grip sheave.

The traction rope is counterweighted in the loading terminal to provide the proper driving tension at the grip sheave. An 8,000-lb. counterweight is attached to a floating tension frame containing two sheaves. This arrangement produces a 2,000-lb. tension.

The discharge terminal is a very simple structure. A 12-ft. diameter tail sheave is mounted on a large stud bearing and is fitted with a roller thrust bearing. The buckets pass around the tail sheave automatically without stopping and dump the load in transit. Buckets return to the loading terminal upside down and are righted by the operator as they enter this station.

Operation of Ready-Mix Plant Held to Be a Nuisance

A DECISION of the Connecticut Supreme Court of Errors, July 19, 1933, was obtained by a property owner against C. W. Blakeslee & Sons, Inc., operators of a ready-mix concrete plant, who also are principal owners of the Connecticut Quarries Co. and the New Haven Trap Rock Co. The court held:

"The operation of a concrete manufacturing plant in the center of a large industrial area in a Connecticut city was a nuisance as to the owner of residential property about 170 ft. from the plant, although it was located in an industrial zone.

"Stone, screened sand and cement were used in the manufacture of the concrete. The stone was brought in trucks carrying 3½ tons and was dumped into a steel plate hopper from which the stone and sand were carried on a conveyor belt and discharged into separate bins adjoining a bin into which cement had been discharged from railroad cars. From such bins the stone, sand and cement were discharged in the required proportions through a steel chute into a concrete mixer which was driven by gearing from a 70-hp. motor and from which the mixture was discharged through a chute into a barrel mounted on a motor truck which was then driven off with the barrel rotating on its axis. The hopper into which the stone was dumped was located 106 ft. from the house and the dumping of the stone into the hopper made a penetrating and nerve affecting sound which could be heard within the house.

"The noise from the various operations of the plant disturbed the occupants of the house during the early hours of the morning and until the late hours of the night, frequently as late as 11 o'clock. The operation of the plant caused cement and stone dust to be carried into the house and upon the walls, furniture and curtains and made it necessary for the owner to keep the windows of the rooms facing the plant closed during the summer months.

"The cement manufacturer's use of his premises was not a reasonable use in view of the unreasonable and unnecessary dust and noise, causing inconvenience, discomfort and damage to the occupants of the residential property. One who lives in an industrial district must suffer from the noise and dirt necessarily incident to life in such neighborhood, but does not assume the burden of inconvenience, discomfort and damage caused by the unreasonable operation of the industrial concerns in his vicinity. The manufacturer could not avoid liability to the owner of the dwelling on the ground that its plant was located in a district which the city had zoned as an industrial district, nor on the ground that the machinery and equipment of the plant were of the most modern standard type available and its operations were similar to the operations of similar plants."

Rock Phosphate

GENERAL business in the Tennessee phosphate section is "on the mend" in expectation of developments in the Tennessee Valley. It is now made clear that the Muscle Shoals nitrate plant will be experimentally operated and may become the center of a great fertilizer industry.

Fifteen of the phosphate counties of Tennessee are on the Tennessee or its tributaries and eight of these are along Duck River, thus making it highly probable that development of navigation and at least part of the large power possibilities of that stream will be put forward for early action under the Roosevelt plan. The entire cost will be quickly amortized by reduced cost of transportation of phosphate rock, and the power can be used right at point of development, with great profit.

While only an incident of the Roosevelt plan, the phosphate industry has such large possibilities as a consumer of electro-chemical power, is of such primary importance to agriculture, and offers such wonderful contribution to the idea of proper combination of agriculture and industry in the same section, that it is sure to be one of the cornerstones of the structure.

Generally better commercial feeling is evident here, and renewal of operations by both of the two largest producers considerably relieves the unemployment situation which has been most acute, causing not only much present distress, but much apprehension for the future.

Mining and grinding the phosphatic limestone which lies under most of the Mt. Pleasant phosphate rock, indicates gratifying increase in the demand for this material for mineral feeds and mineral supplement to mixed feeds for poultry and livestock. One large company has produced this product for several years under a nationally advertised trade name, while the second individual producer is only in his second year of extended production for the trade, though his present activities are the natural extension of the production of this product for use on his own and neighboring farms, begun by his late father nearly twenty-five years ago.

Both products are about the same and sell at same price level, with apparent satisfaction to the trade and receive approval of several experiment stations as furnishing in satisfactory form in one product, compounded by nature, both the phosphorus of bone meal, and the calcium of limestone, both of which materials are rather expensive in the condition of extreme purity required by the feed industry. The increased use of this product is a reflection of the necessity of reducing costs for farmer consumed articles, and at the same time maintaining high quality of materials.

Shipments of ground rock or lime phosphate for direct application will not move much before August, but increased interest is manifest, while the iron and steel trade consumers of furnace lump, will soon again be in the market if general industrial improvement continues. As actual shipment to the fertilizer manufacturing consumers approaches normal, the present extreme low prices accepted for lump rock will advance, it is hoped, to at least the living figures justified.

Wyoming Deposits

PHOSPHATE ROCK deposits in southwestern Idaho, near Green River, Wyo., have been investigated and reported upon by Robert D. Pike (*Industrial and Engineering Chemistry*, March, 1933). These deposits are owned by the Stockholders' Syndicate of Los Angeles, Calif. Mr. Pike came to the conclusion that the way to process this material is as a combination of phosphoric acid with potash, obtainable nearby in the Leucite Hills of Wyoming. This would make possible a combined fertilizer of such high concentration that it could stand relatively high freight rates. Interesting possibilities are outlined for the production of compounds of sodium as by-products.

Lime

THE National Lime and Stone Co., Findlay, Ohio, is defendant in a $100,000 damage suit brought as a result of an automobile accident in which a car driven by a company salesman collided with one driven by a woman.

Rock Products News Briefs

Sand and Gravel

Arkansas Sand, Gravel and Stone Producers Association has been organized to expedite application of the N. I. R. A. code. R. S. Wilson, Big Rock Stone and Material Co., Little Rock, is president; C. S. Young is secretary-treasurer.

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The proposed national code has given the sand and gravel industry more publicity in local home-town newspapers than any event in the history of the industry. Delegates to the Chicago convention in July are quoted at considerable length—in some cases their portraits were published. It is a fine opportunity to put these industries on the map, and all producers are urged to take full advantage of it.

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Mississippi Aggregate Co., Jones Crossing, Miss., recently put its new plant in operation. An unusual feature is that the plant is powered throughout with gasoline engines. Screens, crusher and conveyors are driven by separate motors. O. J. Towley is manager.

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Kinsman Sand and Gravel Co., Kinsman, near Andover, Ohio, recently began construction of a new plant. William Adrian is general manager.

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Three States Sand and Supply Co., Cincinnati, Ohio, is asking Federal permission to dredge a harbor at its proposed unloading dock on the right bank of the Ohio river above the Southern railway bridge. The harbor will be 700 ft. long. Permission is also asked for the construction of a circular pier with a diameter of 25 ft., which will support a revolving derrick. The company proposes to dredge sand and gravel in the Ohio river for a distance of 15 miles, beginning at Modoc bar to a point above Lock and Dam No. 38, below Aurora, Ind.

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Sangravel Co., Louisville, Ky., is seeking Federal permission to dredge sand and gravel for commercial purposes from the Ohio river between Rome, Ohio, and Dam No. 33, and between Dover, Ky., and Augusta, Ky.

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Several sand and gravel companies in various parts of the country have announced that they have adopted the President's blanket code, pending approval of the code of the mineral aggregate industries.

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Wisconsin producers have adopted a code under the auspices of the Wisconsin state marketing department, which is designed to take care of state industrial recovery as the N. I. R. A. does for the country as a whole. The code was adopted by producers of 88% of the total sand, gravel and crushed stone production of the state. The code provides a maximum of 40 hours per week for unskilled labor; a minimum wage of 40c per hour; elimination of cut-throat competition by establishment of an average cost of production; division of the state into three districts for administrative purposes under boards elected by the producers themselves but answerable to the governor of the state. Of 49 producers in the state, 33 attended the code meeting, which was held under the auspices of the Wisconsin Materials Association. A. A Laun is president of the association; Gordon F. Daggett is executive secretary.

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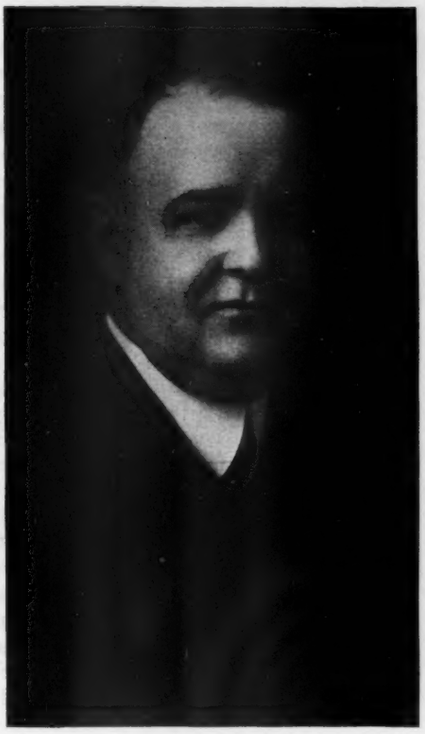
Tri County Sand and Gravel Association, Detroit, Mich., whose organization was noted in Rock Products, July 25, p. 38, has a central purchasing agency as well as



C. F. Carey

a central selling one. The association is composed of a group of small producers who operate roadside trucking plants. These producers, it seems, suddenly woke up to the fact that they were being individually victimized by buyers who played one operator against another.

C. F. Carey, secretary-manager of the association, is a public relations counsellor, who has had a wide experience in trade association activities. His entry into the field came through his being consulted by one of the producers. He has had experience in operating both central selling and central purchasing bureaus. Part of his present work has been organization of responsible trucking contractors to haul the material from plant to job. Under the scheme of organization no material will be sold except on a delivered price basis, thus eliminating some so-called "dealers," or independent truckers who had sprung up here, as well as in most other parts of the country, through ability to own or operate a second-hand truck and to buy material at cut-throat prices at the pits.

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Cement

North American Cement Corp., Security, Md., is now marketing flue dust as a fertilizer for direct application to the soil. The flue dust consists chiefly of burned lime with a small percentage of available potash, according to the description of the material filed with the Interstate Commerce Commission for freight rates, which adds that "its value is less than burned lime or prepared fertilizers but greater than limestone." An article in a recent issue of *Business Week* described the product in glowing terms as "Valuable Dust." The flue dust is being recovered by the new "Multiclone" mechanical dust collector of the Western Precipitation Co., as well as with Cottrell electrical precipitators. This company was one of the first to install dust collectors during the war to make a potash byproduct.

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Nebraska: Governor Bryan gave his personal endorsement recently to a plan sponsored by citizens of Weeping Water to obtain $1,500,000 of Federal Public Works money to build a state cement plant; included in the ambitious plans of Weeping Water citizens are lime and crushed stone plants as well. There are already two cement mills in the state, one at Louisville, only a few miles from Weeping Water. Evidently Governor Bryan is not familiar with the objectives of the NIRA.

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T R C Corporation, Milwaukee, Wis., has issued specifications covering Motor-Bound Macadam, using a new temperature resisting cement made at the plant of the Manitowoc Portland Cement Co., Manitowoc, Wis. A contract was let August 5 for a trial section of pavement on Country Trunk B, north of Manitowoc.

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Calaveras Cement Co., San Andreas, Calif., is making water shipments from Stockton, Calif. A new all-water rate of 13c. per 100 lb. from Stockton to Long

Beach has been established. This rate is only ½c. above the rate from Stockton to San Francisco and permits the Calaveras plant to compete in southern California.

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Illinois: Governor Horner has notified the Federal Administrator of the NIRA that he wants to be heard when the proposed code of the portland cement industry comes up for public hearing. He is still kicking about the uniformity of bids received this spring. Some things the people of Illinois have overlooked are brought out in the following letter of the editor of ROCK PRODUCTS to the *Chicago Daily News*, where it was recently published:

COSTLY SAVING

A recent Springfield dispatch to a Chicago newspaper stated that Gov. Horner desired to have the state's viewpoint presented before any code under the national recovery act is approved for the cement industry. The article cited the controversy which the governor has had with cement companies since early in his administration. Gov. Horner, of course, deserves commendation for any action that actually will benefit all the people of Illinois. However, has not his handling of the cement purchase really injured the people of Illinois much more than it has benefited them?

The claim that he saved the state a substantial amount in his recent purchase of cement is open to question. After two months' delay, during which he refused to buy cement at the price quoted, he finally induced one manufacturer to cut his price and agree to sell 2,000,000 barrels of cement. On the basis of this purchase it is declared that he saved the state some $350,000. When all the facts in the matter are disclosed, however, a different conclusion is reached.

Gov. Horner's delay is reported to have kept about 30,000 men out of work for a period of two months. In seasonal work like road building such lost time cannot be made up. At $25 a week, which is a conservative average compensation for this class of work, the governor's delay entailed a total loss in wages and purchasing power to Illinois citizens of more than $6,000,000, or more than fifteen times the amount the governor is said to have saved.

In addition, newspapers report that suits will be filed against the state by road contractors having contracts for road work on the ground that they were injured by Gov. Horner's delay in providing cement for the jobs. It is estimated by persons familiar with such matters that the total damages that may be recovered by these plaintiffs may exceed the $350,000 which the administration is credited with saving. When all these facts are considered it is difficult to avoid the conclusion that, instead of saving Illinois money, Gov. Horner's two months' delay in buying cement is costing the state and its citizens several million dollars in losses.

NATHAN C. ROCKWOOD.

Chicago.

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Marquette Cement Manufacturing Co., Chicago, Ill., announces election of the following officers: Stuart Duncan, chairman of the board; W. A. Wecker, president and treasurer (Mr. Wecker was formerly vice-president, secretary and treasurer); W. W. Dickinson, vice-president (formerly a director); Richard Moyle, Sr., vice-president in charge of operations (formerly general superintendent); V. J. Hanley, secretary and assistant treasurer (formerly assistant secretary); D. S. Colburn, assistant to the president; (formerly manager of the company's service bureau); F. L. Jaeger, general sales manager (formerly Southern sales manager); Frank Moyle, general superintendent (formerly assistant general superintendent). The Marquette company recently had a full-page advertisement in Chicago newspapers headed "Courage conquers a valley," featuring the development of the Mississippi Valley at "the dawn of a new day." It is a very fine example of prestige advertising.

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Federal Trade Commission has released an abstract of its report to the United States Senate. These conclusions are drawn:

"(1) There is no company manufacturing or selling portland cement with a sufficient proportion of the business to constitute a monopoly in any section of the United States.

"(2) Associations of dealers have engaged in activities which tended to restrict sales of cement by manufacturers to or through those who are recognized as legitimate dealers by the Associations; and which tend to control terms of sale and methods of distribution of cement by manufacturers in such manner as may constitute a violation of the anti-trust laws. These activities are being given further consideration with a view to determine whether corrective action should be taken.

"(3) Cement manufacturers in southern California have been active in establishing resale prices of cement to consumers which the dealers through their state and local organizations maintain. This practice, however, involves only intrastate business over which the Federal Government has no jurisdiction.

"(4) The multiple basing point pricing system as developed by the cement industry has a tendency to lessen price competition. The system forms the basis for arriving at uniform delivered prices of cement and destroys the value of calling for sealed bids by the Government and other large purchasers. The promptness of all manufacturers in meeting changes in delivered prices caused by changes in basing point prices, emphasizes the rigid application of the system by the industry. Certain incidental practices correcting conditions which threatened the uniform application of the system, such as uniformly adopting arbitrary prices at certain points and acting in concert with dealer organizations in penalizing and eliminating sales of cement for truck delivery, have strengthened the effectiveness of the multiple basing point pricing system. These situations are receiving special consideration for the purpose of determining whether they involve violation of law.

"Price competition in the cement industry might be restored in large measure if each manufacturer in submitting bids would quote an f. o. b. mill price, based on his own operations and independent of any knowledge or information as to how competitors probably will arrive at the prices they will submit."

Unofficially, ROCK PRODUCTS is told that the report given the senators also contains this statement: "A careful examination of the records of the Portland Cement Association failed to disclose any evidence of activity affecting sales polies or price of cement in violation of the anti-trust laws."

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The new law governing the sale of securities should have a bearing on this case (reported *El Paso* (Tex.) *Herald-Post*): "Eugene S. Gates, whose Midwest Investment Co. in El Paso sold thousands of dollars of National Portland Cement Co. stock to El Pasoans, has organized a new company for sale of stock, El Paso stockholders were advised today. In letters to stockholders, Mr. Gates, now president of the National Portland Cement Co., announced that the National By-Products Co. has been formed to utilize waste products from the cement mills in California. He announced that every stockholder of the National Portland Cement Co. will receive a free share of stock in the new company for each share of cement stock. He said that it also is planned to sell shares of the by-products company stock to get money to pay off indebtedness of the National Portland Cement Co. El Paso stockholders never have received dividends from their cement stock."

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Portland Cement Association has resumed advertising in many states as a result of action taken at the recent annual meeting in New York City.

Newspapers will be used to support the Association's program and to inform the public on the merits of concrete construction. Subject matter and schedules will be determined by the marketing opportunities in specific localities.

The Buchen Co., Chicago, Ill., advertising agency, which was retained by Portland Cement Association early this year, for trade and business paper advertising, will also handle the newspaper program.

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Michigan State Cement Plant, Chelsea, Mich., was offered at public auction August 15. Seven bids were received. The highest was by D. L. Spickler, of Detroit. He offered $70,000 for the land and equipment. The state has spent in the neighborhood of $1,000,000 on the institution. Other bids were: Harry Lenick, of Saginaw, $21,500, without the real estate; Morris Birnbaum, Wyandotte, $27,000, for buildings, equipment and real estate; Contractors Exchange Equipment Co., Detroit, $12,500, for real estate and plant; Samuel Gilbert, Beaver Falls, Pa., $21,110, for plant and real estate; Woodmere Scrap Iron and Metal Co., Lansing, $6,500, for machinery and metal only; Morris Nover Iron Co., Saginaw, $27,500, for equipment and buildings only.

Crushed Stone

Newburgh's, N. Y., city manager has admitted selling 240 cu. yd. of crushed stone, produced by a municipally-operated quarry and crushing plant, for $130 less than its net cost of production. The price was 95c per cu. yd. The cost of production was about $1.50.

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Wilna, N. Y., a town near Watertown, has no legal right to sell crushed stone, produced at a municipal quarry, in competition with privately owned plants, according to a state supreme court decision. Justice Smith, who rendered the decision, held that the town's contract to furnish stone to a highway contractor, Soper, was illegal. He said, in part: "The public welfare argument defeats itself, because the effect of the town's furnishing the stone from its crusher is to deprive others of opportunity to labor and to be compensated without taxation on the one hand, and on the other hand to weaken the tax-paying power of private enterprise engaged in the business of selling crushed stone; moreover, as the state pays the town, out of emergency relief funds, 40% of the payroll in running the town crusher, the town of Wilna is profiting at the expense of the taxpayers of the state at large—a vicious result of unlawful conduct."

The Soper contract being illegal, the individual town officers are personally liable for any loss which may result to the town, Justice Smith says. He quotes many pertinent decisions from other actions in point, and states that the public interests are imperiled, and concludes that the town of Wilna has no power to sell crushed stone.

"Its only power is to maintain the quarry to crush stone for use on the public highways of the town. The conduct of the town officials constitutes such a flagrant flouting of the limitations of the statute, and their acts in this respect are so clearly beyond their powers, as to amount to usurpation of power. Usurpation of power by public officials constitutes an assault upon law and order and is fraught with public mischief.

"The defendant Soper is entitled to no consideration, because the illegality of the conduct of the town officials was as well known to him as to the town officials themselves; in any event, ignorance of the law would give him no excuse.

"The motion for temporary injunction restraining the illegal official conduct of the town and its town officials must be granted. Ordered accordingly."

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Ohio State Highway Department is operating its own crushed-stone plant near Aberdeen in Brown county. The estimated cost of production is about $1 per ton.

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Marble Cliff Quarries Co., Columbus, Ohio, received interesting publicity in a local newspaper. A picture of one of its quarries was shown under the caption: "This Stone Will Be Used for Food." The story which followed described the use of ground limestone in livestock feeds — very helpful publicity.

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L. & M. Stone Co.'s, Prospect, N. Y., president, William McGrew, received considerable publicity in the *Utica Press* as a result of his trip to the mineral aggregates code meeting in Chicago in July. The article based on an interview gives some of the statistics of the aggregate industries—more helpful publicity.

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Southern Mineral Co., Winfield, La., has received an order for crushed-stone ballast from the Louisiana and Arkansas R. R. to cover its entire roadbed from Hope, Ark., to New Orleans, La.

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Accident Statistics in connection with the National Crushed Stone Association's safety contest for 1932 are now made available by the U. S. Bureau of Mines (No. H. S. S. 90). There were 40 open pits and 2 mines in the contest. In 1930 there were 74 in all. Other statistics reflect the inactivity of the industry in 1932.

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Gypsum

United States Gypsum Co., Chicago, Ill., has extended its asphalt roofing operations by purchase of the Sifo Products Co., St. Paul, Minn. On June 12 the U. S. Gypsum Co. entered the asphalt roofing and shingle field by acquiring the McHenry-Millhouse Manufacturing Co., South Bend, Ind. The Sifo Products Co. has been in business since 1865 and has extensive distributing facilities in the central and northwestern states. It will be operated as the Sifo Products division of the U. S. Gypsum Co.

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A. M. Longoria, Monterey, Mexico, has recently completed a plant to make ¼-in. gypsum board, reinforced with native fibre.

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National Gypsum Co., Buffalo, N. Y., announces the purchase of the Macoustical Engineering Co., Cleveland, Ohio. The official announcement reads, in part: "The need of acoustical correction in larger buildings is a matter that has been receiving continually increased attention of late years. The demand has grown until now it represents a rather highly developed and profitable market. At this very moment we look to the governmental building program to open up a large additional volume of immediate business for acoustical plaster."

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Silica

Minnesota Mining and Manufacturing Co., Wausau, Wis., beginning July 21 went on a 6-hour shift basis with a 10% pay increase. The company, formerly the Wausau Abrasives Co., is now operating 24 hours a day, filling orders for sand-paper abrasive, filter sand and roofing granules. A patented process of coloring the granules has been developed. Plans are under contemplation for extensions to the plant to enable it to double its capacity.

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Jay G. Miller, of the Miller Coal and Silica Sand Co., Lewiston, Penn., has acquired the properties of the defunct Eastern Silica and Chemical Corp., near Gore, Frederick county, Va. It is reported Mr. Miller plans rebuilding and operating the plant. He is said to have paid $2,600 for the plant, which cost to build around $150,000.

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Charles H. Bradshaw, of H. E. Buckingham & Co., Memphis, Tenn., is president of a new company which plans to develop a deposit of fuller's earth, near Ripley, Miss. Fleming Brown is vice-president and general manager; P. A. Raiche, consulting engineer of the Canal Construction Co., Memphis, is also consulting engineer of the new company and is preparing plans.

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Wisconsin State Legislature has appointed a joint committee of both houses to investigate the silicosis problem. Granite and silica producers in the state are complaining that rates for compensation insurance are so high because of the alleged silicosis hazard that they are unable to reopen their plants. Recently both houses of the legislature passed a bill reducing compensation benefits in silicosis cases by one-half, but the bill was vetoed by the governor who urged the working out of protective measures by employers.

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Haymon Krupp & Co., El Paso, Tex., whose operation for producing diatomaceous earth was noted in Rock Products, July 25, p. 48, have changed their brand name from "Cel-O-Lite" to "Sil-O-Mix" to avoid infringement of the trade name "Celite" owned by the Johns-Manville Co.

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Sand and Gravel

Statistics of the results of the National Sand and Gravel Association's 1932 safety competition for the Rock Products trophy award are now available from the U. S. Bureau of Mines (No. H. S. S. 91). Only 37 plants took part in the competition as compared with 76 in 1930. There was only one fatal accident in this group in 1932 as against four in 1930. Both accident frequency and severity increased over 1931.

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Cement

Los Angeles, Calif., dispatch to the *Pacific Coast Edition of the Wall Street Journal* says:

From interests affiliated with the cement industry in Southern California it is learned that a number of factors are pointing toward an ultimate increase in the price of cement

in the Los Angeles district. With the recent increase of 25 cents a barrel in the price of cement in the eastern states, the average price in that area is now slightly higher than the price in Southern California, although the cost of manufacture in the latter district is higher than in the East.

Wages in the cement industry in California are being advanced quite generally in response to the President's request and hours of work have been shortened, requiring the addition of men to the pay rolls. Another factor that is increasing costs and indicating the necessity of higher prices to the consumer is the general increase in practically everything that is purchased in the form of materials required by a cement plant.

The leading cement companies operating in Southern California are endeavoring to hold their prices down in compliance with the President's request to advance wages now and defer price advances as long as possible. The opinion of men in the trade is, however, that an ultimate increase in price is inevitable, and just how long this advance can be postponed is a moot question.

The current retail price of cement to dealers is $1.72 a barrel, but cement sold on large contracts for government and municipal works is substantially lower in price, reducing the average price to approximately $1.50 a barrel. Based upon the present estimates of new cost under existing conditions, the increase in price, if adopted, will probably be not less than 10 cents a barrel, according to men in the industry.

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Wisconsin state highway department will be able to avail itself of its low-priced cement contract made June 9, when bids were accepted for 1933 requirements, at prices ranging from $1.20 to $1.40, per bbl., mill base. The price today is 25c. higher. The highway commission has announced that satisfactory arrangements have been made with the U. S. Bureau of Public Roads and with the several cement companies through which they will furnish contractors with cement at the same prices they agreed to sell the state. The regulations of the U. S. Bureau of Public Roads require the contractor to buy his own cement.

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Tennessee Valley Authority, Knoxville, Tenn., announces that a government-owned cement plant is part of its project. The September issue of Rock Products will carry an authoritative article on the cement industry of Tennessee quite clearly demonstrating that this section already has more *modern* cement mills than are likely to be required for some years to come.

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Peerless Portland Cement Co., Detroit, Mich.; a bondholders' protective committee for first mortgage 6½% bonds will be formed shortly. Interest on these bonds due July 2 was not paid.

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Monolith Portland Cement Co., Los Angeles, Calif., reports for the 6 months ended June 30 net earnings after all charges of $117,872, compared with a net loss of $103,757 for the last 6 months of 1932; or an income of $14,115 for the 12 months ending June 30, 1933. Net earnings for the quarter ended June 30 were $99,731.

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Cement Products

Montville, N. J. A new concrete burial plant has begun operation in northern New Jersey. William Conklin is the proprietor.

Several undertakers in Montville and surrounding towns have approved Conklin's product, a triple-seal vault, and have arranged to handle it exclusively.

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Cinder Block and Material Co., Indianapolis, Ind., is preparing to make and sell precast concrete joists for residence floors. This company has sold cinder block walls for more than 550 residences.

Lower Waste Lime Rate

CO-OPERATING with the Union Carbon and Carbide Corp., which has reduced loading and switching charges on waste lime for agricultural purposes, from $9 to $6.50 a ton, the South Shore Railroad announces the following rates, to expire Dec. 31, 1933, from Sault Ste. Marie to upper Michigan peninsula destinations:

Chippewa, Mackinac and Luce counties, 50c per ton; Marquette, Alger, Baraga, (except Mineral Range), Houghton (except north of Hancock), and Ontonagon county, to and including Bergland, 60c a ton; Mineral range in Baraga county, Houghton county north of Hancock, and Gogebic county, to and including Junet siding, 70c a ton.

Minimum carloads of 20 tons are specified for these rates.

Sand-Gravel Rate Challenged

QUESTIONING authority of the Interstate Commerce Commission to increase rates previously set by it without a finding that they are unlawful, the Missouri Gravel Co. has asked for an injunction repressing the increase, in the Federal court at St. Louis.

The order which is challenged raises the rate of 88c a ton on sand and gravel from La Grange, Mo., to Jacksonville, Ill., and other stations on the Wabash Railroad to $1.01 a ton.

The gravel company declares that the increased rates will prevent it from obtaining business at the localities mentioned in the complaint at any and all times.

Proposed I. C. C. Decisions

25715. Sand and Gravel. Louisiana Highway Commission vs. L. and A. et al. By Examiner L. B. Dunn. Rate, sand and gravel, Antoine, Ark., to Atkins, La., proposed to be found unreasonable for the future to the extent it may exceed the rates prescribed in sand, gravel, crushed stone and shells, 157 I. C. C. 498, determined in accord with the findings and the order in that case for computing rate making distances. The examiner said that since the finding proposed by him was practically an interpretation of an outstanding order, no order for the future was necessary.

25540. Bituminous Rock Asphalt. O. W. P. Macklin vs. I. C. et al. By Examiner W. M. C. Cheseldine. Dismissal proposed. Rates, bituminous rock asphalt, Rockport and Bowling Green, Ky., to Decatur, Ind., not unreasonable.

25270. Fluxing Limestone, Etc. Calcite Quarry Corp. et al. vs. Reading Co. et al. By Examiner C. W. Berry. Rate, fluxing limestone, and crushed or broken limestone, not finely ground, Myerstown, Pa., to Vulcanite, N. J., unreasonable to the extent it may exceed $1.12 a gross ton. Rate to Pittsburgh, McKeesport, West Homestead and Etna, Pa., not unreasonable or unduly prejudicial. Rate from Myerstown to Youngstown, Ohio, unreasonable for the future to the extent it may exceed $1.76 a gross ton. New rates recommended.

I. C. C. Decisions

24717. Cement. Southern Cement Co. vs. Alabama Great Southern Railroad. By division 2. Rates on cement, C. L., from North Birmingham, Ala., to destinations in official territory and Wisconsin and to points in Iowa and Missouri on the west bank of the Mississippi River, found not unreasonable. Certain shipments found to have been misrouted, and charged on others found to have been in excess of those applicable. Reparation awarded.

24840. Sand and Gravel. East Tennessee Sand and Gravel Co. vs. Southern Railway Co. et al. By division 5. Rates on sand and gravel, C. L., from Elizabethton and Siam, Tenn., to certain destinations in Virginia found unreasonable. Reasonable rate prescribed, and reparation awarded on shipments from Elizabethton. Certain Virginia intrastate rates on the same commodities found to be unduly preferential of shippers in intrastate commerce and unduly prejudicial to shippers in interstate commerce. Undue prejudice directed to be removed.

24850. Sand and Gravel. B. G. Coon Construction Co. vs. Pennsylvania Railroad Co. et al. By division 3. Rate on sand and gravel, C. L., from Carpenterville, N. J., to Sandt's Eddy, Pa., found unreasonable. Reparation awarded.

25245. Crushed Stone. By division 5. Hiddenite Granite Co. vs. Yadkin Railroad Co. Rates on crushed stone, C. L., from North Carolina to Virginia and South Carolina points, between North Carolina points moving interstate, and from Tennessee points to North Carolina points, found unreasonable, except those moving over the Atlantic & Yadkin. Reasonable rates prescribed for the future and reparation awarded.

25498. Silica Sand. McClain Fire Brick Co. vs. Pennsylvania Railroad Co. By division 3. Rate on silica sand, C. L., from Mapleton, Pa., to Irondale and New Salisbury, Ohio, found to have been unreasonable. Reparation awarded.

24144. Sand. Continental Roll and Steel Foundry Co. et al. vs. N. Y. C. Railroad Co. et al. By division 2. Interstate rates on sand, C. L., from Polk, Pa., found unreasonable to Kendall and Coraopolis, Pa., but not unreasonable to Erie, Glassport, and Homestead, Pa. Reparation awarded.

THE INDUSTRY

New Incorporations

Calumet Cement Products, Inc., Dyer, Ind. Capital stock 500 shares at $50. Will operate lumber yard, dry kilns and warehouse. Clarence E. Hearne, Frank J. Johnson and Joe W. Todd are the incorporators.

Tri-County Sand and Gravel Sales Co., Detroit, Mich., to deal in gravel and sand, with an incorporation of 1,025 shares no par value.

Atkinson Sand and Gravel Co., Atkinson, Neb., incorporated for $1,500. Arthur A., Elsie L. and James F. Humpal and E. G. Witter are the incorporators.

Kinsman Sand and Gravel Co., Aurora, Ohio. 300 shares no par value $5,000. Carl R. Adrion, Jean MacGregor and R. C. Wheeler are the incorporators.

New England Cast Stone Co., Providence, R. I., to deal in cement blocks. Capitalization $5,000 divided into 500 shares at $10 each. Alfred T. Ciccone and Guisseppe Giudici of Providence and Batista Cocca of Pawtucket are the incorporators.

Saranac Lake Sand and Gravel Co., Inc., Albany, N. Y., has been chartered.

Michigan Talc Mining Co., Detroit, Mich., recently organized by Walter J. McCoy and associates with a capitalization of $150,000, has taken over a large talc deposit under lease and will install new mining, grinding and finishing plant.

Diamond Spring Sand and Gravel Co., Lake Wis., with 500 shares common stock no par value to operate a gravel pit and deal in sand and gravel. A. and C. E. Grabske, J. V. and H. R. Schmitz are the incorporators.

Durable Rock Asphalt Co., Inc., Indianapolis, Ind., capital stock, $1,000 shares no par value to deal in raw, processed and manufactured materials. Incorporators are: William T. MacDonald, Tom Kinnevey and E. V. Brown.

Central Florida Superior Sand Co., Ocala, Fla., capitalization of $5,000 divided into 50 shares, part value, $100 each. J. J. Taylor, D. White, L. W. Duval are the incorporators.

General Minerals Corp., Indianapolis, Ind. Capital stock, 1,000 shares no par value. To deal in raw, processed and manufactured materials. Incorporators are: Thomas D. Fleming, E. C. Shireman and H. A. DeTurk.

Five Oaks Lime and Stone Co., Inc., Tazewell, Va. Maximum capital, $25,000. To quarry and crush stone, manufacture lime and all its products and by-products. C. W. Steele is president.

Franzese Cement and Concrete Corp., $5,000, filed by Benjamin Richmond, 26 Court Street, Brooklyn, N. Y.

Ornamental Colorcrete Products Co., incorporated by George F. Free and M. H. Cashion. To manufacture ornamental concrete bird baths, etc.

Southern Products and Silica Co., Lilesville, N. C., incorporated by Clyde Harrelson and F. J. Cloud of Charlotte.

South Side Cement Block Co., Inc., Chicago, Ill., incorporated with 200 shares par value common. The incorporators are Achille and Andrea Liberatore and Amadio Scarsello and they intend to manufacture, buy, sell and deal in and with cement.

Theobald Sand and Crushed Stone Co., Inc., Newark, N. J., capitalization $75,000.

Sand and Gravel

Consolidated Sand and Stone Co., Sioux Falls, S. D., operating gravel pits near here and a stone quarry near Spencer, now has its offices in the Boyce-Greeley Bldg.

Grundy county commission has opened another gravel pit west of Dike, Ia. The gravel will be used on road resurfacing projects.

Cape Girardeau Sand Co., Cape Girardeau, Mo., announces completion of a new sand bin and the installation of auxiliary equipment.

Consumers Sand Co., Olathe, Kan., recently forced into receivership, now has filed a petition for voluntary bankruptcy in the Federal court at Topeka.

Whitehead Bros. Co., Cleveland, Ohio, now is receiving shipments of sand taken from a glacial quartz deposit 60 miles south of Albany, N. Y., via the river-lake route.

M. T. Epling, Gallipolis, Ohio, sand and gravel operator, has opened up a new gravel pit on an island in New River near Pearisburg.

Good Roads Gravel Co., Newark, Ark., has been sold to A. Jordan Hughley of Fayetteville. Mr. Hughley plans to reorganize the company and resume operations in the very near future.

River Sand and Gravel Co., Owensboro, Ky., has purchased the river front property of Allied Mills, Inc., feed manufacturers. The terminal, which will be improved, has a river frontage of four city blocks.

P. J. Weisel Industrial Sand and Silica Co., near Corona, Calif., is carrying on modernization projects which include new bins, conveyors and cleaning equipment.

Three States Sand and Supply Co., Cincinnati, Ohio, has leased river front property formerly operated by the Ohio River Sand and Gravel Co.

Obituaries

Marshal Beck, secretary-treasurer of the Great Lakes Portland Cement Corp., died July 28.

John Gallagher, retired sand and gravel contractor, died at his home in New York, N. Y., August 8.

Charles A. Mendenhall, a workman, was crushed to death when he was caught in a pulley at the Monolith Portland Midwest cement mill recently at Laramie, Wyo.

Frank W. Peek, Jr., chief engineer of the General Electric Co. plant at Pittsfield, Mass., recently was killed when his automobile was struck by a train.

Deane McCreagh Parrish, treasurer, Economy Concrete Co. and secretary of the Concrete Pipe and Products Co., Inc., Richmond, Va., died suddenly August 17.

Morris Fortuin, general manager for the northern division of the Pennsylvania-Dixie Cement Corp., who has been seriously ill for eight months, died at his summer home near Nazareth, Penn., August 22. Mr. Fortuin was a native of Holland, coming to this country at the age of six years. He began his career in the cement field with the Rosendale Natural Cement Industry in New York City; he later joined with the Pennsylvania Cement Company when it was organized in 1898, rising from the position of salesman to that of vice-president and general manager.

Cement

Dewey Portland Cement Co., Kansas City, Mo., has let contract to North American Car Co. for 200 tons of fabricated structural steel for its new clinker building.

Huron Portland Cement Co., Detroit, Mich., has begun operations on its new 75,000 bbl. plant at Oswego, N. Y.

California Portland Cement Co. announces the removal of its Los Angeles office to the Edison Bldg., 601 West 5th Street.

Petoskey Portland Cement Co., Petoskey, Mich., reports a $15,000 damage to its plant from lightning.

Superior Portland Cement, Inc., Concrete, Wash., for the second year of operation without accident, recently was awarded the official safety trophy of the Portland Cement Association.

Aetna Portland Cement Co. has leased dock property at Saginaw, Mich., for new warehouse facilities.

Pacific Portland Cement Co., San Francisco, Calif., announces through its vice-president, J. A. McCarthy, that all of its departments will function in accordance with the NRA provisions. "This means," he says, "that our entire office force will be placed on a five-day week."

Personals

George W. Gauntlett has been elected president and general manager of the Pioneer Sand and Gravel Co., Seattle, Wash., succeeding B. F. Morris. For the past 10 years Mr. Gauntlett has been connected with the Grays Harbor Construction Co. of Aberdeen, one of the largest producers of sand and gravel in the state.

Albert Moyer was elected president of the Vulcanite Portland Cement Co., New York, N. Y., to succeed the late W. D. Lober.

Lester J. Backus, president Ladd Lime and Stone Co., Cartersville, Ga., recently had a narrow escape while fishing in the sound off Saint Simons' Island. His boat capsized in a storm and Mr. Backus was forced to swim ashore.

Howell J. Davis, president of the Volunteer Portland Cement Co., Knoxville, Tenn., among civic leaders here urging NRA participation on the part of all business and professional men, recently said: "We must increase purchasing power and the only way to do that is to pay employes more in wages."

Sidney P. Armsby, formerly of Houston, Tex., now is working on the development of lime sales for the California Chemical Corp., San Francisco, Calif.

John A. Blank, consulting chemist of the Landa Portland Cement Co., Puebla, Mex., has returned to his home at Ironton, Ohio, after spending a year assisting the Landa company in development of their new cements.

Victor Brooks, formerly connected with the Ladd Lime and Stone Co., Cartersville, Ga., now is manager of the Cherokee Farm Products Corp.

John S. Sullivan now is representing the Dewey Portland Cement Co. in Kansas City. He was formerly connected with the Ready-Mixed Concrete Company of Kansas City.

Walter E. Howard, general manager, Superior Ready Mixed Concrete Co., Cincinnati, Ohio, has been commissioned a colonel on the staff of Governor Laffoon of Kentucky.

Maximillian C. Kolinske, president of the Central Ready-to-Mix Concrete Co., Milwaukee, Wis., recently suffered a severe injury to his hand in a motor truck accident.

Trade Literature

Belt Idlers. Bulletin No. 569 illustrates and gives specifications for the line of conveyor belt idlers designed for the wide range of application. Data in detail for return, flat belt, troughing and idlers. JEFFREY MANUFACTURING CO., Columbus, Ohio.

Eye Shields. Directions for using a sandblast mask designed for use on sandblasting and other occupations where harmful dusts are encountered, are contained in four-page illustrated circular. Laboratory report quoted credits this mask with 99% efficiency. CHICAGO EYE SHIELD CO., Chicago, Ill.

Tractors. Illustrations in this 12-page booklet show industrial tractor units in action on construction projects. Difficulties successfully met by tractor units on hard construction work are described in detail. ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wis.

Lubrication. Charts, diagrams and photo reproductions accompanying the text in booklet describe economical and efficient systems of lubrication for construction machinery engines used in excavating and erecting operations. Best lubrication for steam, electric, Diesel and gasoline units outlined. July 1933 issue of Lubrication. THE TEXAS COMPANY, New York, N. Y.

Dirt Remover. 12-page booklet describes application of new electric power hauling-dumping-spreading units. KOEHRING COMPANY, Milwaukee, Wis.

Drills and Breakers. Booklet PBD-100 (24 pages) covers line of paving breakers, ranging in weights from 49 lb. to 75 lb., sheeting drivers, bolt drivers, clay and trench diggers. Supplementary folders illustrate and describe lightweight hand held drills and a 46 lb. sinking drill unit. GARDNER-DENVER CO., Quincy, Ill.

Manufacturers

Acheson Oildag Co., New York, N. Y., announces change-over to the schedule called for by NRA regulations in its plant producing colloidal graphited products.

Smith Engineering Works, Milwaukee, Wis., announces that the Telsmith balanced vibrator now is available in single, double and triple decked models. Units are made in seven sizes from 2 by 6 ft. to 4 by 12 ft., single, double or triple deck. In the double deck vibrator, two inclined frames move up and down but in opposite directions, balancing the vibratory movement. Shafts are of heavy steel alloy with journals in roller-bearing mounted central of the steel frames. They are designed to handle either wet or dry material and the use of water sprays is recommended. Telsmith patented piston ring seals protect the eccentric against both water and grit.

Sullivan Machinery Co., Chicago, Ill., announces that its district sales office formerly located in the Railway Exchange, St. Louis, Mo., and its warehouse, formerly located at Mt. Vernon, Ill., are now combined under the direction of D. M. Sutor, 2639 Locust Avenue, St. Louis.

Plymouth Locomotive Works, Plymouth, Ohio, has supplied six 8-ton Plymouth gasoline locomotives to operate over the World's Fair short line railroad leading to the fair grounds at Chicago.

Equipment Manufacturers' Review Section

This section of the Roll Call edition of ROCK PRODUCTS is dedicated to the advertisers in this issue, who have cooperated with the publishers to make it possible, for the purpose of furnishing readers the latest news or developments from these leading machinery and equipment manufacturers.

It is published as a summary suggestive of the modern methods and equipment suited to help operators in the rock products industries in meeting their enlarged opportunities under the changed conditions now confronting them. The high premium placed on mechanical efficiency by the multiple shifts of labor, and the higher cost of man-power under the N. I. R. A. code provisions, add new importance to a review of this nature.

MATERIALS HANDLING AND POWER TRANSMISSION

Chicago, Ill.—The Link Belt Co. lists its catalogues, booklets, etc., which contain complete descriptions of its extensive line of materials-handling and power transmission in the following abstracts. In asking for copies the nearest plant or office of the company should be addressed. They are located at the following points:

Chicago. Caldwell-Moore plant, 2410 W. 18th St. Chicago plant, 300 W. Pershing Rd.
Indianapolis. Ewart plant, 220 S. Belmont Ave. Dodge plant, 519 N. Holmes Ave.
Philadelphia. (Plant) 2045 W. Hunting Park Ave.
San Francisco. (Plant) 400 Paul Ave.
Los Angeles. 361-369 S. Anderson St.
Louisville, Ky. 1195 Starks Bldg.
New Orleans. 619 S. Peters St.
New York. 2680 Woolworth Bldg.
Oakland, Calif. 526 Third St.
Atlanta. 511 Haas-Howell Bldg.
Baltimore, Md. 913 Lexington Bldg.
Boston. 1208-9 Statler Bldg.
Buffalo. 331 Ellicott Square.
Cleveland. 566 Rockefeller Bldg.
Dallas. Mercantile Bldg.
Denver. 521 Boston Bldg.
Detroit. 5938 Linsdale Ave.
Grand Rapids. 540-1 Michigan Trust Bldg.
Kansas City, Mo. 1004 Baltimore Ave.
Pittsburgh. R. 2125, 436 Seventh Ave.
Portland, Ore. 221 S. W. Front Ave.
Seattle. 820 First Ave., S.
St. Louis. 3638 Olive St.
Wilkes-Barre. 826 Second Nat'l Bank Bldg.
Toronto. (Plant) Eastern Ave. and Leslie St.
Montreal. 934 Inspector St.
Vancouver. 550 Beatty St.

Link Belt Bulletins

No. 640, *Plants for Washing Sand and Gravel.* Complete description of Link-Belt plants for washing sand and gravel. 72 pages: 188 illustrations.

No. 1095, *Locomotive and Crawler Type Cranes.* Built for heavy-duty service, with electric, gasoline or Diesel engine drive, locomotive cranes also furnished steam operated, when desired.

No. 1292, *Car Spotters.* Presenting the Caldwell Electric Car Spotter; a quicker, cheaper, easier way of placing cars exactly where you want them. From one to six loaded cars can be handled.

No. 960, *Dewatering Screws.*

No. 1615, *Belt Conveyor Data Book.* Complete data on design, installation, operation and maintenance of belt conveyors. Gives formulae, tables and helpful engineering suggestions.

No. 1289, *Caldwell Conveyor.* A complete catalog and price list covering our line of Original Caldwell Helicoid and Sectional-flight Screw Conveyor, and accessories.

No. 1362, *Vibrating Screen.* Effective screening by means of the Link-Belt Vibrating Screen—"A triumph of Mechanical Vibration." 16 pages; 22 ilustrations.

No. 1267, *Stock Sprockets.* Over 20,000 sprockets always carried in stock. All wheels carefully fitted to standard chains. This book lists the stock wheels.

No. 500, *General Catalog.* A 1,088-page hand book and catalog of materials handling and power transmitting methods and equipment. The most complete book of its kind ever published.

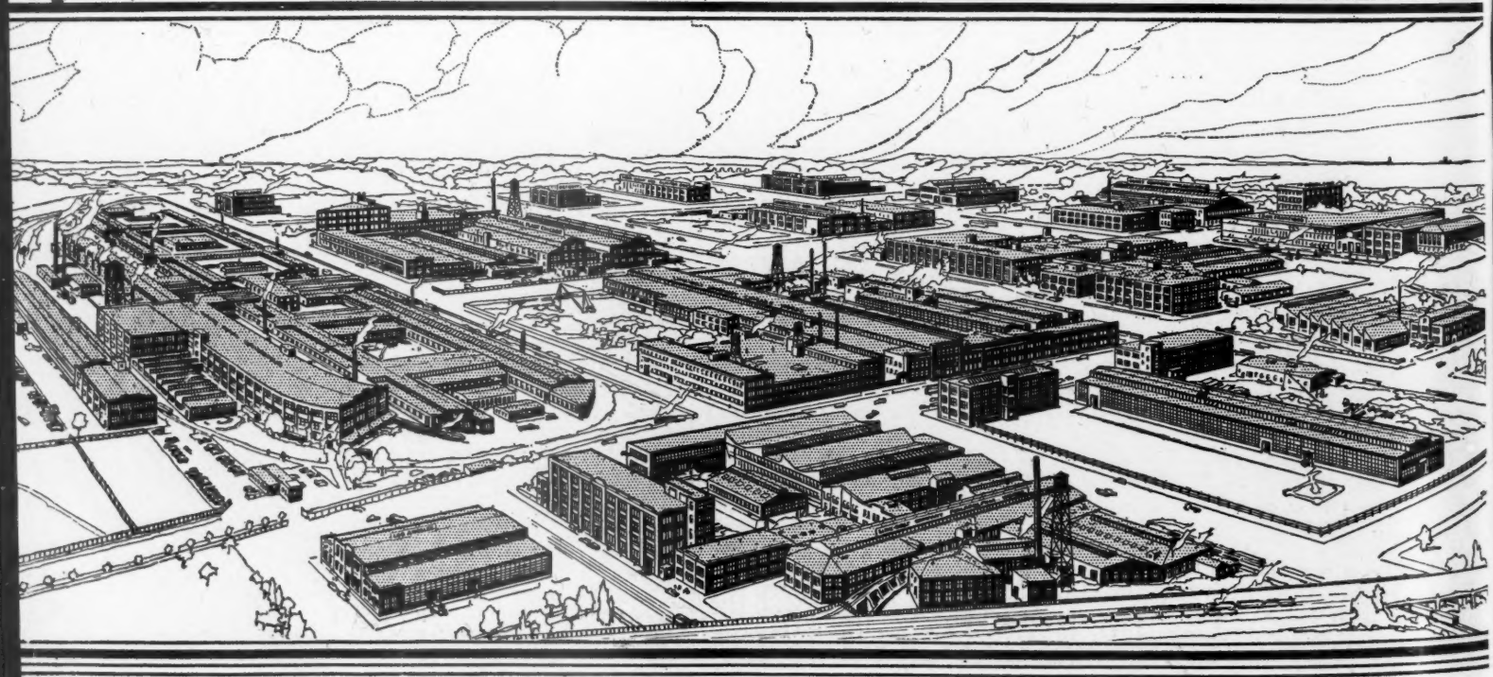
Nos. 1248, 1298, *Portable Conveyors.* Conveyors and Loaders for coal, coke, ashes and similar loose materials. "The best that money can buy." Send for Folders No. 1248 and No. 1298.

No. 946, *Skip Hoist.* Especially adapted for high lifts, elevating abrasive or corrosive materials, and handling large lumps, as well as fines. Capacity to suit needs.

No. 1050, *Promal Chains.* An original Link-Belt development which has achieved a combination of higher tensile strength and wear resistance than ever before attained in cast chains.

No. 125, *Silent Chain Data Book.* Recognized as an authoritative work on silent chain practice and design. Shows how to figure drives and determine prices.

No. 1274, *P. I. V. Gear.* A Data Book



Composite of Link-Belt Co. plants

on the P. I. V. Gear. A Positive, Infinitely Variable Speed Transmission.

No. 1933, *A Century of Progress Souvenir Book.* A 52-page Link-Belt Souvenir Book of the World's Fair.

No. 481, *Conveyors for Glass Plants.* Complete handling systems for glass plants.

No. 1457, *Roller Chain Data Book.* A text book on roller chain drives, 96 pages. Data and engineering information.

No. 1192, *Steel Chains for Conveying and Driving.* Complete information on all types of steel sprocket chains.

No. 1351, *Heavy Duty Apron Feeders.* For all abrasive materials.

No. 1256, *The "Grizzly" Crawler Loader.* The "King" of loaders. For all loose materials. Has self-feeder and large handling capacity.

No. 1215, *Herringbone Speed Reducers.* Containing data on the use and application of speed reducers.

No. 1341, *"RC" Flexible Coupling.* The new Link-Belt Roller Chain Flexible Coupling.

No. 1208, *Conveyor Belts and Training of the Belt on Conveyor.*

No. 1319, *Automatic Coal Stoker.* For boilers up to 250 hp. the Link-Belt Underfeed Screw Type Stoker.

General view of Link-Belt Co. display at a Century of Progress Exposition, Chicago, Ill.

BELTING

Akron, Ohio.—Paul W. Van Orden, manager of belting sales for the B. F. Goodrich Co., gives a significant reply to the question: "How long should a conveyor belt last?"

"Many operators," says Mr. Van Orden, "have found the most satisfactory method of expressing conveyor belt life to be the *cost of belt per ton delivered,* computed by merely dividing the purchase price of the complete belt by the number of tons delivered during its period of use. The wide variation in conveyor belt costs can be understood only after a consideration of many factors which invariably fall into one of the following classifications. (1) Requirements and conditions under which the conveyor must operate. (2) Factors under the control of the operator. (3) Factors under control of the designers and manufacturers of the equipment.

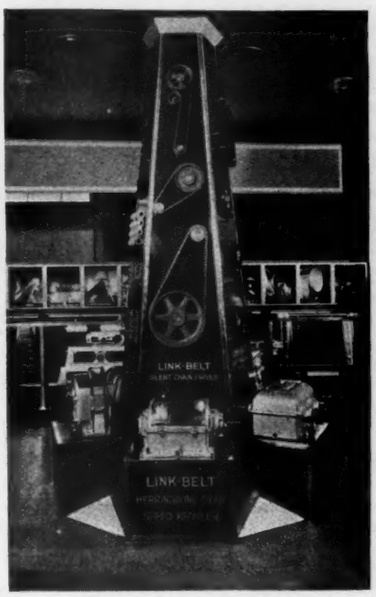
"A long belt will generally outlive a short one because it comes under the loading chute less often. Although tonnage delivered is directly proportional to the length of the belt, the original cost of the belt is directly proportional to its length. Therefore, the cost of the belt per ton delivered might appear to be uniform regardless of length. If more than one loading point is used, this would not hold true. (Furthermore, it would not hold true of belts handling hot materials since the surface of a long belt would be damaged more because of its prolonged exposure to hot material.) Length of the belt is, however, but one of several considerations, a few of which are suggested here.

"Wider belts afford larger proportional tonnage since the volume of the load increases as the square of the width, while the wear is more nearly in direct proportion to the width. Obviously, with heavier material, greater tonnage delivery is obtained, even though other conditions are equal.

"Although it is known that exposure to any of these will cause more rapid deterioration of the belt cover, the rate of deterioration is very difficult to calculate. It is estimated that the average cost per ton of handling hot material is roughly ten times normal cost.

"Because handling of abrasive materials causes more rapid wear of the belt cover, the belt cost per ton is higher. Lump material not only wears out belts faster than fine material but increases the possibility of damage when lumps become wedged against supports or between belt and pulleys.

"Because high lifts necessitate heavier fabric reinforcements, the unit cost per belt is higher in such cases. High lifts create higher tension in the structure of the belt, thereby rendering the belt more liable to wear and injury.



Silent chain drives exhibited by the Link-Belt Co. at Chicago World's Fair

"Care should be exercised in installing belts. They may be hopelessly damaged or run crooked if the belt is not cut squarely at the joint. Correct alignment of idlers and trippers, if maintained, will prevent crooked running and edge injury. Every belt operator knows that improper belt lubrication leads to trouble for, when idlers become stuck, they wear sharp and cut the belt. If idlers turn hard, the load is increased and the operator must increase belt tension. Another common source of belt damage is the accumulation of material on pulleys. The purchase and regular use of cleaning devices is recommended to all users of conveyors.

"One of the important causes of belt trouble is excessive tension. Tension must be controlled by the operator or the belt structure will be endangered. If excessive tension is necessary to prevent slipping, it may be relieved by pulley lagging or other corrective means.

"Buyers of conveyor belting usually judge belts according to tensile strength of cover and weight of duck. Too frequently the particular construction methods employed by the manufacturer are overlooked. It is conceivable that two belts apparently equal in value and price will frequently show wide variation in tonnage delivery and life.

"This condition exists today despite constant efforts of belt manufacturers to improve conveyor belt quality. And although it is true that the belt user's dollar will buy twice as good a belt as it would have 10 years ago, perfection in belt construction has not been attained by *any* manufacturer. In view of this, the alert buyer of conveyor belting should keep himself in position to take advantage of improvements offered by individual manufacturers. He should insist upon accurate service records from the operator for a true check on both the performance of his belts and claims for them.

EXPLOSIVES

Wilmington, Del.—The Atlas Powder Co. cites three comparatively new developments of interest to rock product industries: The Atlas Accordion Fold electric blasting cap package; the Apex explosive and Blastix, an aerated form of black blasting powder.

Safety and convenience are given as the features of the Accordion Fold package. Wires are laid around the cap to protect and cushion it at sides and ends. The package keeps the wires folded in accordion fashion so that they extend naturally into position when it is opened. Priming may be done without disturbing the rest of the folds.

Engineers, in developing the Apex explosive, followed the general line of progress which has been toward accurate control of chemical forces liberated by explosives. Their study of rock formations emphasized the need for explosives having the properties of speed and strength in balance so that stress on the burden produces the desired fragmentation as well as volume. The claim made for Apex explosives is that they exert a stressing, rather than a severe, shattering action. The company recommends its own cartridge closure for use with this explosive in order to secure greater water resistance.

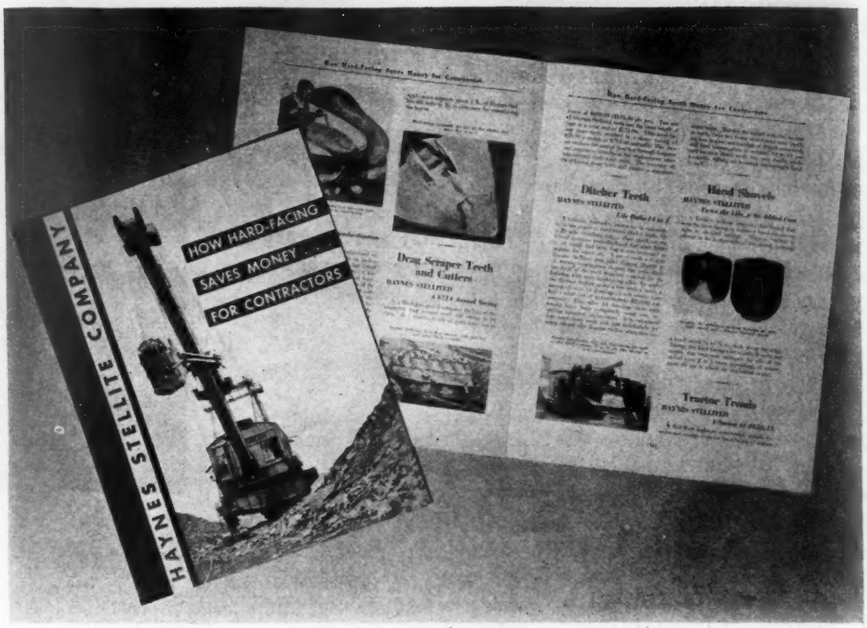
Blastix is an aerated type of black blasting powder. While its primary application perhaps is in the coal industry, it also may prove valuable in rock blasting operations where black blasting powder may be used. Moisture resistance, plus safety and convenience are suggested as advantages of the Blastix cartridge.

Branch offices of the Atlas Powder Co. are located in the following cities: Allentown, Penn.; Boston, Mass.; Denver, Colo.; Houghton, Mich.; Joplin, Mo.; Kansas City, Mo.; Knoxville, Tenn.; Memphis, Tenn.; New Orleans, La.; New York, N. Y.; Norristown, Penn.; Philadelphia, Penn.; Pittsburgh, Kans.; Pittsburgh, Penn.; St. Louis, Mo.; Tamaqua, Penn.; Wilkes-Barre, Penn.

HARD-SURFACING

Kokomo, Ind.—The Haynes Stellite Co., unit of Union Carbide and Carbon Corporation, and manufacturer of abrasion- and corrosion-resistant alloys, announces publication of its new booklet, "How Hard-Facing Saves Money for Contractors." This 16-page booklet describes how increased life and savings are effected through the application of hard-facing materials to wearing parts of excavating, dredging and road building equipment. It is of special interest to the rock products industries where such a large percentage of the equipment is subjected to extremely severe abrasion.

Several types of hard-facing materials are discussed including Haynes Stellite, the nonferrous cobalt-chromium-tungsten alloy, Hascrome, a chromium-manganese-iron alloy and Haystellite composite rod which consists of particles of crushed tungsten carbide bonded together with either steel, Haynes Stellite or Hascrome. The procedures for hard-facing by both the oxy-acetylene process and the electric arc method are also briefly described, and such useful hard-facing information as recommended welding processes, thickness of deposits, metals that can be hard-faced, etc., is listed conveniently in a table.



New source of hard-surfacing data

The greater part of the booklet is devoted to actual applications where the hard-facing process has been used to protect wearing parts of many types of excavating and dredging equipment. Among the applications discussed are dipper buckets, dragline buckets, clam-shell buckets, dredging cutters, orange peel buckets, drag scraper teeth and cutters, ditcher teeth, tractor treads, hand shovels, brake drums, etc. Copies of this booklet may be obtained from the Haynes Stellite Company, Kokomo, Ind.

Specific cases are given in this booklet and also in the magazine, *Oxy-Acetylene Tips*, indicating the wide scope and economy resulting from the strategic use of hard-surfaced equipment. Several of these cases are quoted here:

"Inspection of a hard-faced five-yard dragline bucket used under extremely severe conditions in a Michigan gravel pit, showed that after two months of continual service the bucket was still in excellent condition. Previous to hard-facing, the bucket lasted for only a few weeks before repair was necessary. This job required 9¾ lb. of Haynes Stellite to cover a patch 6 by 36 in., and an area on the runner 5 by 36 in.

"A dragline bucket at a Long Island sand and gravel company lasted 2½ times as long after the lip had been hard-faced. About four lb. of Haynes Stellite was used to protect the lip from the abrasive action of sand and gravel and approximately 2 hours were required for the hard-facing operation.

"A new cement-mill application for Haynes Stellite is on tube mill discharge spouts, which are 10 ft. inside diameter and resemble a 45-deg. pipe elbow. Since they are expensive to remove, they are hard-faced before installation. About 37½ lb. of Haynes Stellite is applied to the entire inside surface of the spout.

"Eight months ago, a Pennsylvania contractor Haynes-Stellited some clamshell bucket teeth and tested them against plain steel teeth. Today, the steel teeth have lost three in., whereas the Haynes Stellited teetn have been so negligibly affected by wear that their surfaces still retain their rough 'as-welded' appearance.

"Six hundred thousand yards of gravel, clay and broken concrete is the record of a 1¼ yd. dragline bucket, hard-faced on the wearing lip with Haynes Stellite. It has not yet been necessary to replace or re-face the Haynes Stellited lip; the bucket is still being used for deep ditch dredging by a Missouri contractor.

"Ordinary manganese steel dipper teeth lasted about one month at a Michigan cement quarry. By Haynes Stelliting these teeth across the full width and back about 4½ in. from the tip, their life was increased to six months."

Hard-surfacing furthers economical maintenance, and aids generally in the rehabilitation program. The oxy-acetylene process, by which most hard-surfacing is done, has other valuable applications in the rehabilitation and maintenance of industry. These excerpts from *Oxy-Acetylene Tips* are indicative of what is going on today in this regard.

"With current economic developments pointing to an early resumption of normal operating schedules, plant executives are devoting serious consideration to the problems of rehabilitation and maintenance of plant equipment. To place a plant in operating condition when capital for new equipment is

limited will require the adoption of an aggressive program of maintenance and repair. Never before has there been a better opportunity to effect substantial savings through the use of oxwelding and cutting. Never before has the oxy-acetylene industry been better prepared to serve the maintenance engineer, plant executive, and welding operator. Always a dominant factor in maintenance and repair, the oxy-acetylene process is indispensable in meeting the problems which exist today.

"Through scientific research, supplemented by practical tests under field conditions, oxwelding methods have been greatly improved during the past few years. Better techniques have been developed for welding steel, cast iron, copper, brass, bronze, aluminum, stainless steels and other metals and alloys used in plant equipment.

"There are available today welding rods with the exact metallurgical characteristics necessary for every welding job in the rock products industries. These rods insure weld strengths which were unobtainable a few years ago. The process of bronze-welding, for example, has been brought to the point where many major repairs can be made right in place, thus eliminating the expense of dismantling and reassembly. By bronze-welding, worn parts also can be quickly and economically rebuilt to original dimensions.

"Heavy machinery for hard service in a great variety of industries, from the mass production machines of a textile mill to the crushers in mines and quarries or road-building equipment of contractors, have in common, aside from the various mechanical parts previously mentioned, cast housings, bases, standards, or frames. Ordinarily, most of these parts are made of either iron or steel castings. Due to the tremendous strains that these parts undergo from the nature of their work fractures due to unforeseen contingencies are quite common. No equipment of this type, no matter how badly it may be worn or smashed up need be discarded as useless, because literally hundreds of experiences exist to prove that economical oxwelded repairs are being carried out every day that are fully as strong and often stronger than the original part.

"Spur, bevel, worm or helical gears for practically all service can be quickly restored to service by oxwelding even when they have been badly smashed or when the gear teeth have been stripped off in spots.

"Gears are all important in industry as the means of transmitting power. When they stop revolving, production stops. Consequently a broken unit or stripped teeth in a modern shop must be quickly replaced or repaired. Replacement not only is expensive but usually shuts down a part of the plant temporarily. It is possible to save the delay and a large amount of the expense by following the example set by a great many plants which use oxwelding both for welding fractures and for building up teeth by bronze-welding. It is interesting to note that in many cases on large gears teeth rebuilt by bronze-welding require no machining."

In the maintenance man's battle against shutdowns and lost time, the Haynes Stellte Co. states that its recommended hard-surfacing operations can, in general, "increase the life of machine parts three to ten times no matter how savagely abrasion attacks them."

WIRE ROPE

Kenosha, Wis.—The Macwhyte Co. in developing its preformed wire rope has employed internal lubrication and preforming to provide improved service for installations where bending is the principal factor tending to destroy the rope.

"Wire rope is a combination of many wires, each wire presenting a bearing surface requiring lubrication," explains a representative of this company. "For this purpose we use the best lubricant that we know of. It protects the inside of the rope from deterioration, usually for a period longer than the life of the rope. Most of the rope stress, of course, is internal where it cannot be seen or inspected. Often the safety of the entire rope depends on the proper condition of the bearing surface of the individual wires on the inside.

"To overcome this problem of lubrication the old method was for the wire rope to be impregnated or flushed with an oil or light grease on the assumption that these lubricating agents would work in between the wires of the strand. Later on a grease that would melt at a comparatively low temperature was poured on to wires as they were formed into the strand and the lubrication of the rope depended on the grease congealing on the individual wires.

"To amply protect the wires in the rope, an ideal lubricant must fill the spaces between the wires to keep out moisture. It must resist ordinary acid. It must have a heavy consistency and be a tenacious substance so that it will cling to the wires and not squeeze out. It must have a high melting point so that it will not run off the rope in hot weather. It must not become hard and scale off under low temperatures. A lubricant having all of these properties was found but for a long time it could not be applied to the rope because it retained its constant heavy consistency even when heated above 200 degrees.

"After long experimenting, we devised a machine whereby this tenacious heat resisting lubricant is fed under pressure to the wires as they are being brought together. The wires are actually squeezed together through a solid mass of lubricant, thereby completely packing all the spaces between the wires and the excess on the outside is then wiped off. Tests of this lubricant put into a rope have shown that it will withstand heat as high as 220° for 312 hours without a sign of the lubricant dripping from the rope.

"Through proper lubrication Macwhyte internally lubricated wire rope resists internal rust, corrosion, and friction; therefore, the inside wires are usually in excellent condition after the outside wires are worn through and after the rope has given maximum service.

"Wire rope can be manufactured both preformed and regular wire rope, the preformed rope being given an additional process which

Wire rope exhibit at World's Fair in Chicago. Drawing of the wire to the desired size is shown in the first of a row of small models of parts of machines. The wire is drawn through three successive dies. Next, this wire and many others are led through holes in a large drum that twists the wires into a rope. To make the finished rope the small ropes are then led through holes in a drum the same as were the individual wires. In this case six ropes are led through holes near the rim of the drum while a hemp rope runs through the middle. They all pass through a smaller drum which revolves, twisting the ropes around the hemp core, thus forming the finished Macwhyte rope used for many industrial purposes.

forms the wires and strands into the exact chemical shape which they assume in the finished rope. They are thus easier to handle, more free of kinking and safer to use than ordinary rope.

"In quarrying the Macwhyte preformed wire rope is recommended especially for derrick main falls, whip ropes and slings."

ELECTRIC MOTORS

Schenectady, N. Y.—Although the products of the General Electric Co. include a wide range of equipment, ranging from switches, capacitors, etc. to apparatus for utilization of the photo-electric relay set-up and Selsyns applications, the synchronous motor remains as one of the primary industrial products of interest in the company's contact with rock products industries.

The cement industry, one of the largest users of electric motors, makes use of large numbers of synchronous motor drives. In fact, approximately half the power used in cement mills is applied to synchronous motors such as now are supplied by General Electric Co. for grinding and pulverizing mills. The super synchronous motor provides a method of obtaining the high starting torque with normal starting current required by these mills.

Large numbers of synchronous motors also are used on air compressors, supplying air for drilling, conveying, agitating slurry, etc. These motors are generally furnished without base and pulley for mounting directly on the compressor shaft.

Nearly all of the motor generator sets used in cement mills employ synchronous motor drives. In one such installation the power factor meter is so connected with the set that it varies the excitation on the synchronous motor to hold the plant power-factor at unity.

Individual installations, representative of the general application include: A battery of five 300 hp. 164-r.p.m. unity-power factor super-synchronous motors, each driving a tube mill in a cement plant; a battery of four 800 hp. 180 r.p.m. super synchronous motors driving raw-grinding and finish-grinding units; eight 700 hp. 124-r.p.m. unity power factor super synchronous motors for driving tube mills.

Over 300 General Electric super synchronous motors with a total of more than 135 hp. already have been installed in the cement industry, most of them on tube and ball mills. The largest such installation is that of the International Cement Corp., New York, N. Y., which operates 67 G-E super synchronous units with a total horsepower of 23,750.

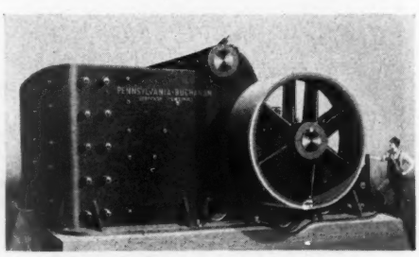
In describing the application of its super synchronous unit to cement mill operation, General Electric Co. says: "Grinding and pulverizing machines may be tubular, cylindrical or conical in shape and perform their functions by means of freely tumbling, internally contained grinding media, such as pebbles, balls or rods. In the application of motor drives to these machines, the principal factor to be considered is that, with bearings in good condition, the required breakway torque may be less than the full driving torque, yet a torque considerably higher than the full-load value may be required to bring the load to full speed. This is because the mass of grinding media and material in process must be rotated at least 45 deg., but in some cases nearly 180 deg. before cascading begins, after which the torque required decreases to the normal full-load value.

"This excessive torque will take excessive amounts of power from the line supplying the motor, unless load acceleration is permitted to extend over a period of 10 to 20 seconds. Such torques may produce severe stresses on the shafting, gears and other mechanical parts. Power surges are often very objectionable to the power-plant operator and breakage of mechanical equipment is expensive because of replacements and production losses. The super synchronous motor applies starting torque gradually and brings the load to full speed in minimum time without excessive power demands or mechanical stresses."

PRIMARY CRUSHERS

Philadelphia, Penn.—Squarely meeting the exacting service requisites for primary crushing equipment, the Pennsylvania Crusher Co. developed the Pennsylvania-Buchanan primary jaw crusher only after extensive engineering research.

"In designing this unit," says an engineer of the company, "the uppermost consideration was to bring out a machine that would be an unquestionable improvement on former crushers of this type. Every functioning



Primary jaw crusher

part was given careful study, not only from the standpoint of strength and durability, but also facility for replacing wearing parts. The substitution of through-bolts for studs, and the use of body-bound bolts instead of loose fit bolts for permanent alignment of some parts, is an example of the attention paid to design detail.

"The frame consists of four parts, two side frames, front and rear heads. These are of cast open hearth steel annealed. Very deep sections are employed for the heads, and both these and the side frames are of the box form of construction, with horizontal and vertical ribs, sufficient in number to give proper distribution of load to the outer members. In the design of these parts, all sections are as uniform as possible, and there are no heavy lumps of metal at any place to cause contraction and cooling cracks.

"The method of joining and holding the side frames to the heads has been accomplished by heavy machined lugs at each end of the frame, fitting snugly to machined mortises in the front and rear heads. This, together with a double row of heavy tie bolts at both ends, gives a straight-line tension distribution to the frames, and the heads are held from tipping by machined lugs which fit tightly to the machined surface of the side frame ends. The side frames are bored for the reception of the swing jaw shaft and removable main bearing shells, which are water jacketed, to insure cool running under the most severe service conditions. The front head is planed for the reception of the stationary jaw plates, and the rear head is planed for contact with the tail piece.

"The swing jaw is an annealed open hearth steel casting, with a very deep section of the box form of construction. Horizontal and vertical ribs distribute the crushing load to the tension member of the casting, and heavy lumps have been eliminated to insure sound metal throughout. It is planed for the reception of the jaw plates, and bored and bushed with removable bushings for the swing jaw shaft.

"The pitman has always been a problem in large jaw crushers. It must be strong and rigid, but undue weight is prohibitive, as the eccentric movement of this member causes excessive vibration and if it is too heavy, the entire crusher is thrown out of balance. This pitman is constructed of special steel shapes, cut and machined to exact measurements, and these parts are then welded so as to give the greatest possible strength and rigidity with the minimum of weight. The pitman is fitted with removable bearing shells and the upper shell is water jacketed.

The toggle system is of new design, only three members being required to act as bearings for both front and rear toggles. This has been accomplished by the unique design of the pitman as only one member is necessary as a central bearing for both toggles. It is placed directly in line with the eccentric shaft giving a straight pull on the pitman no matter in what position it may be, and is therefore self aligning.

The toggles are of unusual design with over three times the usual bearing area, and consequently with bearing pressures proportionately light. A safety feature is also provided in the rear toggle. The toggles are fitted with a liberal lubrication system, which is serviced at readily accessible points. The complete lubrication has been given careful study, with the result that these crushers will require only a fraction of the lubricant necessary for earlier designs.

Both swing jaw and eccentric shafts are of forged steel, and of very large diameters to insure rigidity and give low bearing pressures as well.

Flywheels, of ample, but not excessive, weight are furnished. The standard machine is arranged for single flat or multiple Vee belt drive, although any of the modern systems of driving can be used.

ALLOYS

Chicago, Ill.—President Evans of the Chicago Steel Foundry Co., says: "On our alloys, Pyrasteel and Evansteel, we have back of us about four to five years experience in the cement industry. In hardly a single instance where they have been used in the cement trade have they failed to prove their value.

"This is evidenced by the fact that some of the large users who experimented with cheaper material during the hard times, have come back again within the last month for Evansteel and Pyrasteel. Our one-piece screw conveyors in some cases have lasted 50 times longer. This represents a saving, allowing for the difference in cost."

BEARINGS

New York, N. Y.—For the tough jobs of the rock products field, S K F Industries, Inc. manufactures anti-friction bearings to deliver the bearing performance imperative in modern operations. "Modernization of equipment to meet present day programs of reconstruction is a vital factor in speeding up recovery," says a spokesman for this concern. "There is a demand for greater efficiency with reduced costs and improved production. All these things suggest the application of ball or roller bearings, or both to existing machinery and on new equipment.

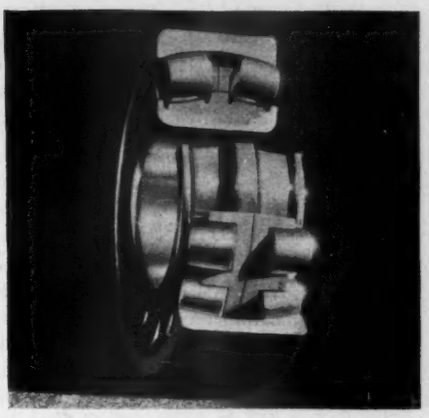
"S K F spherical roller bearings are especially adapted for the brute work encountered in the rock products industry. Hour after hour they insure dependability where ordinary bearings would quickly fall. They practically eliminate friction, run smoothly and insure long life and low cost operation on all types of machinery in this field.

"Ruggedness and stamina are the two outstanding characteristics of this bearing. It is the same bearing that has been used for years on the leading railroads of America, not only on railway coaches but also on the drivers of locomotives, considered to be the supreme test of bearing stamina, and indicating the amount of punishment this bearing will take."

S K F spherical bearings are used for cement mill drives, on crushers, vibrating screens, concrete mixers, and a wide variety of applications with complete success reported by their makers, under gruelling service conditions.

S K F bearings are made in a wide variety of types to meet practically every need of the rock products industry. In addition to the S K F spherical roller bearing, there are also S K F cylindrical roller bearings, S K F deep-groove ball bearings and S K F self-aligning ball bearings.

For more than a quarter of a century the



Spherical roller bearings

S K F organization has been manufacturing ball and roller bearings to high standards of quality. "Where dependability is demanded," declares the company, "and careful consideration is given to operating costs, S K F bearings are used by leading manufacturers of equipment for the rock products industry."

PULVERIZING

New York, N. Y.—Referring to articles printed in Rock Products, May 21, 1932, and April 25, 1933, regarding the installation of B and W type B pulverizers in the Whitehall Cement Manufacturing Co. plant, Cementon, Penn., the Babcock and Wilcox Co. announces further improvements in this installation which attracted nation-wide attention from cement mill operators. A limiting factor of the installation as described in the Rock Products articles has been overcome by the installation of a continuous bucket elevator. This now provides a production of more than 41 tons per hour of raw material—mostly natural cement rock.

The company continues to stress the economy permitted by the use of its pulverizers in the reduction of cement raw materials. They operate in closed circuit with a mechanical classifier, and reduce cement rock or clinker in a single operation to such fineness that the product may be delivered directly to the kilns or silos. "Our equipment," says the company, "occupies less space than that usually required, and the fixed charges and maintenance costs are materially lower. Furthermore, the power ordinarily required for raw-material grinding is reduced as much as 50 per cent, and that for clinker grinding approximately 30 per cent."

E. H. Fromm, New York City, is manager of the cement division of the Babcock and Wilcox Co. Personnel of the cement division also includes H. B. Smith, New York; M. R. Woodward, Chicago; J. G. Burke, Atlanta, and G. C. Barnaby, San Francisco.

Summing up the advantages of the B and W. pulverizer, a cement division executive says: "The great output of our pulverizer is due to the rapidity with which the material passes through the mill, the plurality of grinding zones and the positive grinding action of the balls. The relatively high efficiency of the type B pulverizer is due to the prompt and complete scavenging of pulverized material.

"All the advantages of direct pulverized-coal firing of kilns may be realized, with a small initial investment, through the use of a pulverizer specially designed by us for use in direct-fired boiler installations. In the past, operators of cement plants have been rather hesitant about taking advantage of the savings to be realized by using the direct-firing for their kilns, especially since many of the direct-fired pulverizers were of such a type that they were unable to maintain proper fineness during the life of the wearing parts.

"The development of the ball-bearing principle pulverizer, however, having one row of balls for the smaller capacity, has made available for the direct-firing of cement kilns, a pulverizer that has a high degree of reliability and a low rate of wear. Our machine for this purpose maintains a uniform high fineness throughout the life of the grinding parts. It is economical to operate."

Elverite, the chilled cast iron product offered by the Babcock and Wilcox Co., is widely used in the reduction and pulverization of rock products, cement clinker, ores and other highly abrasive materials. The reliability and economy of the B and W Pulverizers are credited by the company in part to the fact that Elverite is used in balls and grinding rings. This metal is also furnished by them in the form of tube-mill linings, slugger plates, roll shells, roll heads, etc. Elverite is cast of pure cold-blast charcoal iron with the mixtures varied chemically to obtain a chilled section of ⅛ in. to 2½ in. in depth, depending on the shape and use of the casting. Adamantine is the manganese chromium steel also used in B and W units for other purposes. It has a hardness of approximately 300 to 500 Brinell as compared to the 525 to 700 Brinell rating of Elverite.

Specifications in Bulletin

Pulverizers. Bulletin F906 gives complete description of B and W Type B pulverizers for cement manufacture. Dimensions of equipment are given. BABCOCK AND WILCOX CO., New York, N. Y.

COMPLETE SERVICE

Allentown, Penn.—The Traylor Engineering and Manufacturing Co., equipped to furnish individual machines or to design and completely equip whole plants for operation on rock products, summarizes its service and machines as follows:

"Traylor jaw crushers are offered in six types, including the 'Bulldog' model, and are available in 35 sizes. The largest size gyratory crusher has a 72 in. opening. Finishing crushers are furnished with the company's patented bell heads and concaves in sizes to seven inches. Roll crushers are produced in three types, including 29 sizes up to 90-in. diameter.

"A Traylor crusher may be secured which will fit most any purpose the producer may have. For any of these crushers we manufacture suitable feeders of several types such as grizzley feeders and apron feeders of the heaviest design. Feeders are not absolutely essential to the successful working of a crusher, but the efficiency of the machine is very greatly increased by the use of a modern feeder which guarantees uniform load.

"For handling crushed rock, we supply elevators of several types, in any size required, and we manufacture a full line of three types of rotary screens in eight diammeters up to 9-ft. or even larger if required, and to any length that may be specified. In addition we supply numerous accessories for stone crushing plants, such as friction hoists, bin gates of many types, apron conveyors, spouts, chutes, etc.

"For the gravel producer, in addition to crushers, elevators, screens, etc., we manufacture a full line of washers and scrubbers of standard and special designs, in any sizes that may be wanted. We furnish partial or complete equipment for the preparation of rock asphalt for road dressing, and at least one large and important plant in this branch of the industry is fully Traylor-designed and equipped.

"For the lime manufacturer and chemical works, we are prepared to furnish rotary kilns, calciners, coolers, etc., in addition to crushing and handling machinery. For plants preparing ground limestone for agricultural purposes or rock dusting or for existing crushing plants having auxiliary departments for this purpose, we have a full line of ball mills of any size needed.

"For the cement manufacturer we have furnished, in sizes from the smallest to the largest, raw and finish grinding mills with single or multiple compartments, rotary kilns, coolers, wash mills, slurry feeders, dry feeders, gypsum feeders, and miscellaneous equipment. We have designed and completely equipped cement plants of various capacities in the United States and foreign countries. In general, Traylor has facilities for taking over the complete design, erection, supervision and equipping of any type of plant for any branch of the rock products industry, whether such plant be a very small one or two crusher size or of the very largest size that may be wanted.

"Our modern shops are strategically situated on the Eastern seaboard within 60 miles of Philadelphia and about 90 miles of New York, and we are therefore in position to make advantageous water shipments to the West Coast. The plant is served by two great railroads, and motor transport facilities are available to points not far distant."

Main offices of the company are located in Allentown, Penn., and district offices are maintained at New York, 2513 Empire State Bldg., in charge of R. R. Shafter, district manager; at Chicago, Rm. 2131, One LaSalle St. Bldg., in charge of D. A. Cheyette, district manager; at Los Angeles, 908-909 Chester Williams Bldg., in charge of W. H. Agens, district manager; and at Seattle, 3410 First Ave. South, in charge of G. W. Walters, district manager. The firm's export office at New York, 104 Pearl Street, is in charge of G. R. Horner, foreign sales manager.

PUMPS

Catasauqua, Penn.—Important announcements regarding new equipment developed by the Fuller Co., makers of rotary compressors, rotary vacuum pumps and pneumatic conveying systems are to be issued in a short time. Just off the press is a new 18-page, loose leaf bulletin describing the company's line of stationary Fuller-Kinyon pumps. It describes the Fuller-Kinyon system thoroughly, and all accessory parts are illustrated with full details. Typical applications of this system to meet various requirements in cement mills and other grinding plants also are given.

This new booklet is supplemented by several pages devoted to the new Type F, stationary Fuller-Kinyon pump, both for grinding mills and for handling bulk cement on construction projects as unloaders for hopper bottom railway cars.

A second supplement of 18 pages describes fully portable Fuller-Kinyon pumps for unloading standard box cars, deep-draft and deck-type barges and for withdrawing cement from ground storage warehouses. Applications of this portable-unit system to all classes of construction projects are illustrated.

MAINTENANCE EQUIPMENT AND CONE CRUSHERS

Milwaukee, Wis.—Reviewing products that have been added to its line in recent years, the Nordberg Manufacturing Co. gives special mention to its underground shovel, both of the rail and crawler mounted types and to its track shifter. The latter machine was developed to take the place of men working with bars and hand jacks for shifting track laterally or raising it vertically as must be done frequently in open pit mines, quarries or on large construction work.

Another line of machines developed within the past years by the Nordberg Manufacturing Co. is a series of power-driven equipment used for track maintenance. There are seven machines in this group, all of which are decidedly special in their design and application to take the place of hand labor so long used on this class of work.

Within the last few years this concern also has developed and introduced a new adaptation of the cone crusher. It is suited particularly for very fine crushing. It is known as the short head cone crusher with a design and construction that has much in common with the standard cone. However, it opens up another field that could not be reached with any other type of crusher, in the opinion of the manufacturer. "The short head, says the company, "has the advantage of fine crushing and at the same time maintaining capacity. It does the job in one operation at a considerable saving in crushing cost. In the non-metallic field this crusher has the distinct advantage over plants originally designed to produce the ordinary sizes but which are now confronted with demands for very fine material."

Reference to this Symons short head cone crusher recalls the absorption in 1928 of the Symons Brothers Co. by the Nordberg Manufacturing Co. The complete Symons selling organization was taken over at the same time.

The Nordberg Manufacturing Co. has been engaged since 1890 in the building of large and specially designed equipment such as steam engines, Diesels, mine hoists, large air compressors and similar machinery. When the disc crusher was developed by the Symons Brothers Co. the machine was built in the Nordberg plant. A similar arrangement was in effect in connection with the development of the Symons cone crusher, originated before the merger of the two companies.

LOCOMOTIVES

Plymouth, Ohio—The Fate-Root-Heath Co., builder of Plymouth locomotives, announces a new 10-ton Diesel powered locomotive. Engineers of the company believe that several decided improvements have been included in the new Plymouth chassis. Side and end frames are made from extra heavy steel to insure perfect alignment. The six-cylinder power plant, solid injection type, with a 4⅞-in. bore and a 6-in. stroke, has developed 95 hp. at 1200 r.p.m. Further specifications are available in the latest circular literature of the company.

The patented Plymouth 4-speed transmission incorporated into these latest locomotive developments makes it possible to apply the same power in forward or reverse. Semi-elliptic springs of the new unit are both side and cross equalized, insuring easy riding over rough and uneven track. This, it is said, practically eliminates any possibility of derailment. Cabs and canopies are made from heavy gauge sheet steel and are fully enclosed.

Operating records of Plymouth locomotives are offered by the company to prove their economy and service power. An executive of the company says, "Ever since the trend pointed toward the acceptance of Diesel power units in prime movers, such as locomotives, our company has designed and built locomotives in various sizes until today the line offers the Diesel locomotive for practically every haulage need."

"A recent development has been the use of a well-known tractor type Diesel in the Plymouth locomotive, and because the engine builder carries a complete line of parts at their various agencies located at strategic points all over the world, the Plymouth user

will receive the finest type of service on engine parts for replacement purposes.

"A Plymouth engineer will gladly make a survey of your haulage problem and recommend the most economical type of Plymouth locomotive to use, whether it be Diesel, gasoline, mechanical or Diesel or gas electric."

John A. Root is president of the Fate-Root-Heath Co.; C. E. Heath, vice-president and general manager; E. W. Heath, vice-president in charge of sales; H. F. Root, secretary, and P. H. Root, treasurer.

INDUSTRIAL CHAINS FOR POWER AND CONVEYING

Milwaukee, Wis.—The Chain Belt Co., organized in 1891, today furnishes a striking contrast to the original company setup which started out with manufacturing operations limited to malleable chains.

In 1900 the elevating and conveying line was added and in 1908, concrete mixers. This latter line has broadened out and now includes many other units such as pumps, saw rigs, plaster and mortar mixers and the recently developed REX pumpcrete, a mechanical pump designed to pump concrete laterally, vertically or both ways, as easily as an ordinary plunger pump pumps water. In 1926 the belt conveyor idler line of the Stearns Conveyor Company of Cleveland became a part of the Chain Belt property.

The imposing list of products made by this company today includes: Chains (drive and conveyor), transmission equipment, castings, conveyors, water screens, sanitation equipment, spray nozzles, concrete mixers, pavers, agitators, contractors' elevators, bulk cement plants and central mixing plants.

Officers of the Chain Belt Co. are: C. F. Messinger, president; J. C. Merwin, Brinton Welser, G. K. Viall, vice presidents; A. R. Abelt, secretary; C. L. Pfeifer, treasurer and W. H. Brandt, assistant to the president.

BELTING

New York, N. Y.—With branches in every industrial center, the United States Rubber Co. offers complete and prompt service to meet all plant demands of rock product operators for conveyors, hose, etc. Products of this company are known the world over.

To show the ruggedness of U. S. belts under heavy-load operation, the company cites such installations as the 237-ft., 27-in. belt (6 by 4 ply) in the Aberthaw and Bristol Channel Cement Works in South Wales. This belt has carried 100 to 150 tons per hour of broken limestone continuously, it is claimed, for several years, and the belt still is in good condition.

At the trap rock plant of the Tomkins Cove Stone Co., Haverstraw, N. Y., every phase of material handling, from the secondary crushers to the storage silos, is taken care of by 14 U. S. belts ranging up to 1,600 ft. in length. Satisfactorily, these belts handled up to 2,500 cu. yd. daily of hard, jagged rock, according to the company.

"Recent technical achievements by our engineers," says a spokesman for this concern, "have placed U. S. conveyor belts upon a high plane of unmatched performance and ultimate economy. These achievements represent something more than mere improvements; they create a new belting technique and open up fields of service hitherto closed to belts because of the severe duty demanded. These achievements are: (1) *New high flexibility.* (2) *Perfect balance of parts.* (3) *"Bacgrip" edge, continuous with covers.*

"The new "U. S." conveying belts, *in all weights and grades,* exhibit both transverse and longitudinal flexibility never before achieved in any make of belt. A bending test of a U. S. belt and any belt comparable in weight and thickness will invariably show greater U. S. flexibility. The new high flexibility has the following very important effects upon operating efficiency and belt life.

"(1) Troughing and training qualities are greatly improved. The amount of materials carried—especially fine materials—is larger. Frictional wear on the back cover is distributed over all the idlers, instead of being concentrated at the sides and edges of the belt.

"(2) The belt runs true, because of the better training when running on all idlers.

"(3) Spillage of material over the belt edges is avoided.

"(4) Injury to the edge, due to transverse rubbing on idlers, is avoided.

"(5) Internal stresses are minimized. In stiffer belts, the resistance to deformation is often great enough to produce a break down of the belting materials. This cannot happen in U. S. conveyor belts."

SHOVELS, DRILLS

Beaver Falls, Penn.—The past year has been one of unusual activity in the engineering and sales departments of the Keystone Driller Co. A new type full-revolving shovel, Model 18, of one-yard capacity, on which work had been in progress for four years, has been brought out.

This new unit is powered by electric motor, gasoline or Diesel engine, and is convertible into plunger (skimmer) for stripping and general excavation above grade; or into trench shovel, for excavation down to 20 feet below grade; a giant hammer for breaking rocks, concrete, etc.; and Clamshell, Dragline, or other crane boom attachments, may also be furnished. All of these utilities are usable on one boom; the change requiring less than two hours, compared with two days on shovels which require a different boom for each utility.

In the line of drills, the new Model 71 has been developed. This is a compact all-steel blast hole drilling machine for holes up to 8-in. It is especially designed for low cost drilling in limestone and sandstone, where 6-in. holes are most economical. This machine is regularly mounted on full crawlers, over half of the weight of the machine (14,000 lb.) being concentrated in the crawlers. This gives it extraordinary stability on steep hillsides, low ground pressure for traveling on soft ground, and ability to scale grades up to 50%, says the company.

The Model 90 is another new model, mounted on two steel wheels and half crawlers, full-traction type, for drilling holes up to 12-in. in diameter, in trap and other hard rocks. It is capable of handling over 4,000 lb. of steel.

SCALES, MOTORS, ENGINES

Chicago, Ill.—Recent bulletins published by Fairbanks, Morse and Co. illustrate the many improved models of Diesel engines, electric motors, scales, etc., now available to the rock products industries from this source.

The application of this company's synchronous motors on the large crushers and other heavy equipment used in these industries is recommended because of the possibilities which they offer for reducing power costs through improvement in power factor.

In plants handling aggregates for contracting work, the company notes: "The general practice of using large hopper scales usually of 5,000-lb. capacity with dials graduated to 5,000 times 5 lb. is met by Fairbanks-Morse scales for this purpose, used to make up batches of aggregates and for weighing out in bulk to determine quantities used.

"In asphalt plants, three scales are used in some typical installations. A large Fairbanks-Morse hopper scale may be provided for coarse aggregates usually having dials of capacity of 10,000 times 5 lb. A dust scale is provided consisting usually of a monorail traveler fitted with a scale from which the asphalt bucket is suspended."

With regard to its automatic recording dial scale installation which cuts weighing time materially, Fairbanks, Morse and Co. say: "Weighing can be a tedious time consuming operation if it is not handled in the modern manner. Dial scales and automatic ticket equipment expedite the process while maintaining established standards of accuracy and sensitiveness.

"Such has been the experience of a large Canadian concern whose business involves shipping large quantities of bulk material by truck."

This installation handles up to 700 trucks per day weighing out some 30,000 tons per month. During a 10 hour day's operations it figures out to approximately one weighing per scale every 32 seconds average. The loads vary anywhere from 500 lbs. to 7-tons and trucks with trailers are quite common.

The installation is located between the platforms on the "in" and "out" driveways. The operator's left hand dial prints "G" for gross, has a capacity of 20 tons and operates with a 30 by 9 ft. scale. The dial on the right prints "T" for tare and operates with a 20 by 9 ft. scale. The printing unit records these tare and gross weights in quadruplicate.

The dials are double faced and have no tare bars. Charts are graduated 20,000 by

20 lbs. with one 20,000 lb. drop weight. The elimination of the tare bar makes the dial units absolutely fool-proof against any false manipulation from the inside.

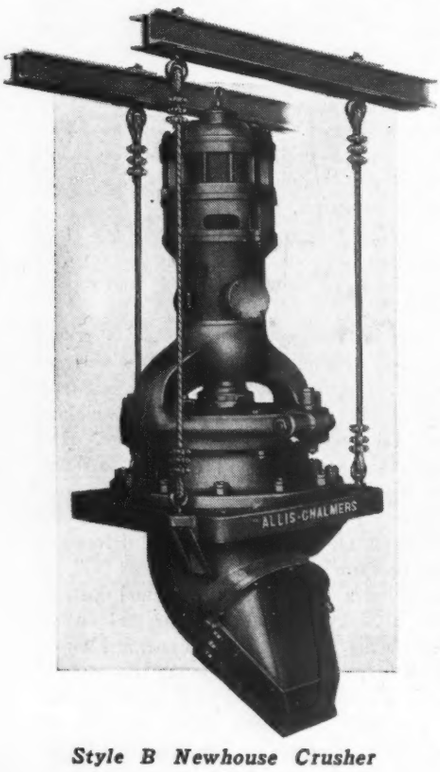
Each dial is equipped with one of the newly designed electrical contactors which in turn operate the automatic electric recorder shown at the center of the picture covering the interior view of the office and which serves both scales.

COMPLETE EQUIPMENT

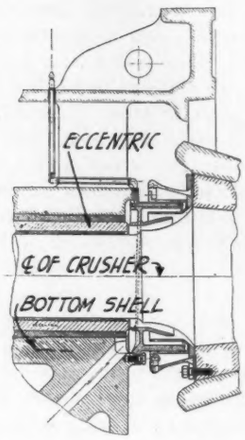
Milwaukee, Wis.—Reviewing the service and the complete line of equipment now offered to operators in the rock products industries, an executive of the Allis-Chalmers Manufacturing Co. says:

"This company continues to maintain a large engineering force thoroughly experienced in the design of complete crushing plants from the smallest to the largest. This assures Allis-Chalmers customers assemblage of the principal and auxiliary equipment to secure maximum results under the conditions in each particular instance. The company also maintains a research laboratory equipped with the latest testing equipment for testing cement making materials and for conducting research work in connection with the crushing, cement, mining and allied industries. The company has developed in all sizes the three principal types of primary crushers, gyratory, jaw and Fairmount single roll type, and is thus in a position to serve prospective customers disinterestedly in the selection of that type most economically suited to each condition.

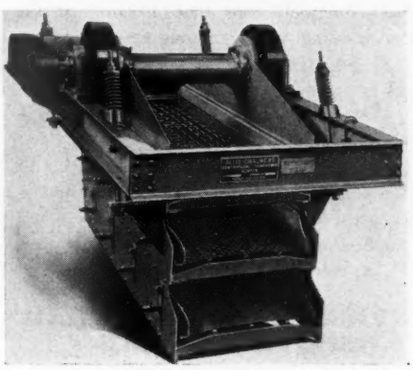
"Among the company's largest installations will be found four 60-in. all steel gyratory crushers installed in Chile, S. A. These crushers have two feed openings 60-in. by 164-in. and weigh approximately 500 tons each. They are the largest gyratory crushers built, and have a capacity of approximately 2,500 tons per hour each. In the United States there will be found two Allis-Chalmers 60-in. gyratory crushers of iron construction operating on limestone.



Style B Newhouse Crusher



Positive dust and oil seal on A-C gyratory crushers



Style B centrifugal vibrating screen

Building not only the principal and auxiliary crushing plant machinery, but also motors, pumps, compressors and power plant machinery, this company is able to supply all this equipment under one contract with one undivided responsibility.

Cement Making Machinery

"There is hardly a cement plant in the United States which does not have some Allis-Chalmers equipment. In the development which has been so large and so rapid there naturally have been many changes and improvements. Equipment which was modern only a few years ago is now obsolete. The company has kept pace with these rapid developments and its line of cement making machinery today stands second to none for the economical manufacture of cement.

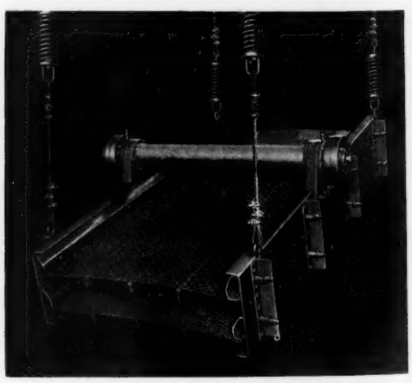
"After several years investigation and experiment Allis-Chalmers has developed and placed in commercial operation a shaking type air quenching cooler having radical advantages over the usual rotary type. The clinker falls directly from the rotary kiln on to a shaking grate which forms a conveying surface. Cooling air from a duct below passes up through the agitated bed of hot clinker with the result that exchange of heat from the clinker to the air is very rapid. The recuperated heat is returned to the process with the primary and secondary air used for combustion in the kiln.

"Besides cooling the clinker and saving fuel by recuperating most of the sensible heat, grinding costs are considerably reduced due to easier grindability of air quenched clinker. The cement produced from air quenched clinker has a more uniform and higher early strength. Power required to operate the shaking element of this new cooler is a small fraction of that required for a rotary cooler and the total power required, including the fan for supplying cooling air, is considerably less than for a rotary cooler installation.

Important is the development of a positive oil and dust seal consisting of baffles and an oil and wear resisting rubber connecting shield with machined steel ring. It prevents leakage of oil and positively prevents dust or water from entering the eccentric bearing. Increase of crusher capacity, permission of close setting, saving of power, lessening of possibility of choking and stalling, and longer life to crushing surfaces by more equal distribution of wear are obtained by use of non-choking concaves which are now being extensively applied to new and installed gyratory crushers. These improvements apply to Gates, Allis-Chalmers Superior McCully and Newhouse gyratory crushers. Newhouse Crushers having large capacities and high reduction, direct-motor drive and cable suspension have met with wide acceptance in the United States and many foreign countries for operation under various conditions, crushing rock or ore.

Vibrating Screens

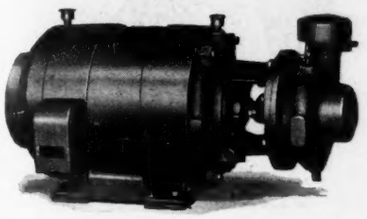
"During the past year two types of vibrating screens have been developed, namely the Aero-Vibe, which is made for screening applications using screen cloth up to 1½-in. openings, and the Style B Centrifugal, which is the improved type of our former centrifugal vibrating screen. The Aero-Vibe is designed for meeting the needs of a smaller and lighter screen for such application as washing and cleaning, coal handling, etc. It is of the unbalanced type, requiring no sup-



"Aero-Vibe" screen

porting frame and the vibratory motion of from 1/16 to 3/16-in. is produced by adjustable unbalanced flywheels driven by means of a Texrope drive. The screen is hung by springs to an overhead structure.

"The established Allis-Chalmers line of centrifugal vibrating screens has been redesigned, the latest being designated Style B Centrifugal, (Bulletin 1475). In Style B screens the vibrating rod for holding the screen body in operating position is eliminated and four compression springs substituted, one attached to each corner of the screen body. This reduces the load on the bearings to a minimum and is a marked improvement over the usual methods used to stabilize the screen body. With this construction the top deck and the other decks are entirely free from any obstruction permitting free discharge. The older bearing pillow block design has also been eliminated



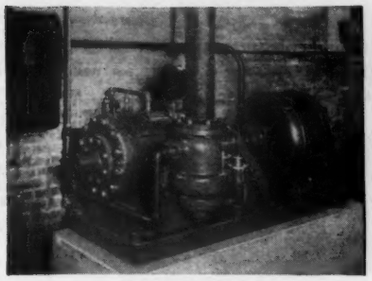
Type SSU pumping unit with totally enclosed fan-cooled motor

through use of a circular bearing housing for the eccentric bearings attached directly to the side plates of the screen body. The method of attaching this housing results in much stronger construction, eliminates several parts and greatly adds to the appearance of the screen. Another feature of the Type B screen is the method whereby the proper crowning of the wire can always be maintained or changed to suit operating conditions and the thickness of the wire used. The features of the Style B Centrifugal screen were incorporated after exhaustive shop and commercial tests which proved, among other things, a considerable saving in starting and running power.

Pump Line Extended

"Several recent additions have been made to the popular line of Type SSU single-shaft two-bearing centrifugal units which are now available for any capacity from 30 to 500 gal. per minute against various heads, in some sizes up to 350 ft. These pumps fill the need for high, medium and low head pumps of various capacities at low cost.

"The pumps and motors are both built and guaranteed by the same manufacturer, eliminating any divided responsibility. The purchasers are also assured that pumps and motors are properly proportioned so as to work together as an efficient reliable unit. A single shaft is used on which to mount the motor rotor and the pump impeller. This shaft is supported by two amply sized ball bearings. This construction does away with



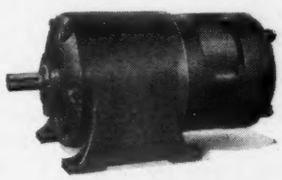
Rotary compressor

any possibility of misalignment between the pump and the motor.

Rotary Air Compressor

"A complete line of up-to-date rotary air compressors and vacuum pumps of the multicellular, sliding-vane type, in both water-cooled and air-cooled designs, is now made available by one Allis-Chalmers, of the country's oldest manufacturers of air-handling machinery. The line covers a range of volumes from 50 to 2,000 c.f.m. at pressures up to 150 lb., and vacuums up to 29.85 mercury. The air-cooled units are suitable for pressures up to 10 lb. G., and vacuums up to 18-in. Hg., and the water-cooled units for higher pressures and vacuums. The smooth operation, small dimensions, continuous delivery and absence of maintenance requirements are a few of the advantages presented. No belts or pulleys are normally required, as the units operate at standard motor speeds. The design is extremely simple, involving no valves or complicated motions. All working parts are totally enclosed, but easily accessible. The addition of these compressors rounds out the lines of centrifugal and reciprocating machines already manufactured by the company.

"Gearmotors have been developed for use where low speed drives are required. A standard round frame type motor is mounted



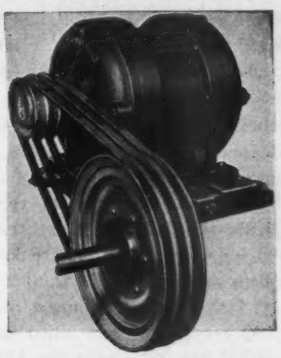
Gearmotor unit

directly on the gear reducer housing thus forming a compact unit. Helical gears are used which permits the highest possible efficiency and the most quiet operation. Standard speeds at the power take-off are from 3.02 r.p.m. to 380 r.p.m., but lower speeds can be provided; 6.08 r.p.m. is obtained with the use of a 1,750 r.p.m. motor.

"Bearings supporting the gear drives are ball or roller type. Lubrication is automatic and continuous insuring an adequate supply of lubricant at all times. Standard units are arranged for floor mounting. Units can be supplied for wall, ceiling or vertical mounting. Any desired type of motor may be supplied—standard squirrel cage induction motor, wound rotor type, enclosed fan-cooled, explosion proof, or direct current. Inherent advantages of separate motor and reducer construction are maintained such as ease of maintenance, replacement of individual units, adaptability to change in ratios, etc. A line of higher speed Gearmotors, with gear housing on the motor frame, is also available for speeds from 195 to 4,000 r.p.m.

Texsteel Texrope drive

"To supply the demand for a lower priced unit, the Texsteel Texrope drive line has been extended for all ratings from ¼ to 15

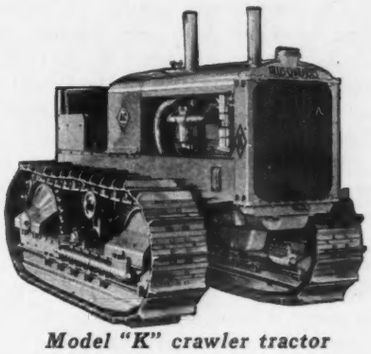


Texsteel Texrope drive

hp. Texsteel sheaves are accurately formed of extremely tough steel, then welded and attractively finished in an aluminum lacquer. They are light in weight and easily installed. The Texrope multiple V-belt drive originated by Allis-Chalmers has been generally adopted for driving crushing plant machinery.

New Tractor and Attachments Ideal for Quarries

"A new addition to the Allis-Chalmers line is the Model K. This tractor develops 48-drawbar hp. and has a high speed of 4½ miles an hour. This medium-sized tractor is a companion in general design to the 76-hp. Model L and is an ideal tractor for rock quarries, because it has the power and speed to do heavy work and is very economical to operate. All Allis-Chalmers track-type tractors have removable cylinder sleeves, inserted valve seats, oil filters, carburized and hardened gears, etc. There is a complete line of special equipment available for attachment to these tractors, such as bulldozers, winches,



Model "K" crawler tractor

scrapers, compressors, welders, side booms, pumps, wagons, etc. The line also includes

graders, both power and hand control, elevating graders, power units of 40, 50, 60, and 90 hp.; dump wagons, wagon track; motor patrol graders and wheel type tractors."

WIRE ROPE

Williamsport, Penn—"Economy does not mean doing without," says the Williamsport Wire Rope Co. "It does mean making your dollar go to its very limit." Performance records of its wire rope installations are cited by the company to prove the true, lasting economy of its line.

General sales offices of the company are located at 122 S. Michigan Ave., Chicago.

LOCOMOTIVES

Rochelle, Ill.—Evidence that the long looked for up-swing actually has begun is contained in the announcement of the Whitcomb Locomotive Co., which reports that through the first half of August, 1933, orders received for the year to date are 58% greater than at the same time in 1932.

H. H. Perry, general manager of the company, reports that orders filled during the same period are 25% over the 1932 period. He says: "Recent business has included both new locomotives and units sold from stock. They have gone to a wide variety of users, principally industrial and contracting, though we look for a substantial increase in activity in the rock products industry as a result of the new public works program."

CRUSHERS AND AUXILIARY EQUIPMENT

Kennett Square, Penn.—The Good Roads Machinery Corp. in continuous operation here for 55 years, has been reorganized with a financial setup which assures its many customers of close co-operation and service. It offers for the crushed stone and sand and gravel producer its well known line of Good Roads Champion primary and reduction jaw crusher, Climax primary crushers, and complete auxiliary equipment such as chain and belt bucket elevators, conveyors, vibrating and revolving screens, apron and reciprocating feeders, wash boxes, bin gates, etc., in addition to its line of road building and maintenance machinery.

The management consists of individuals long connected with the business: R. S. Tucker, general manager; W. D. Polk, general sales manager; W. E. MacDowell, service manager; C. W. Grady, engineer, and John Bowman, plant superintendent.

Sales are handled through a strong dealer organization: The Good Roads Machinery Co. of New York, New York, N. Y.; The Good Roads Machinery Co. of New England, Watertown, Mass.; The Roy C. Whayne Supply Co., Louisville, Ky.; Wilson-Weesner-Wilkinson Co., Nashville, Tenn.; Tractor and Machinery Company, Atlanta, Ga.; North Carolina Equipment Company, Raleigh, N. C.; Richmond Machinery and Equipment Company, Richmond, Va.; John C. Louis Company, Baltimore, Md.; Earle Equipment Company, Detroit, Mich.; Towner Road Machinery Company, Muskogee, Okla.; A. L. Young Machinery Company, San Francisco, Calif.; M. A. King, Builders Bldg., Chicago, Ill.; L. C. Perry, St. Louis, Mo.; H. Y. Smith Company, Milwaukee, Wis.; P. D. Frack, Pittsburgh, Pa.; P. Z. Martin, Blue Ball, Penn., and L. E. Walker, Colmar, Penn.

BELT CONVEYORS

Aurora, Ill.—The Barber-Greene Co. has brought the advantages of standardization to a wide range of belt conveyors for the handling of all materials used in the rock products industries under a wide range of conditions.

Although they are industrial units, conveyors made by this company are so standardized as to their parts that they may be assembled in complete working units like "Meccano" toys or sectional bookcases. Each unit is manufactured on a quantity production basis. The full range of parts in stock permits quick delivery and prompt assembly. The standardized conveyors may be easily lengthened, shortened or otherwise adjusted to changing conditions of a job or they may be disassembled and set up on another operation calling for an entirely new combination.

Unit parts include: drives, take-ups, sectional frames, carriers, belt and power parts. Other accessories, required for special conditions, such as gravity take-ups, snub drives, special ends, etc., also are furnished. All kinds of sand, gravel and heavy materials are well suited for handling on Barber-Greene conveyors.

SHOVELS

Chicago, Ill.—The Northwest Engineering Co., manufacturer of shovels and cranes and draglines, devotes two new booklets to the detailed description of the Northwest Model 80 2-yd. shovel and to the new features in design and construction of the 1¼, 1½ and 1¾-yd. machines produced by them.

In regard to the Northwest Model 80, the company claims that it gives a 3-ft. shorter tail swing, allowing operation in close working quarters, "for the first time" with this capacity shovel. This compactness permits shipment without major dismantling. Husky boom and dipper sticks also are pointed to by the manufacturer as features of this unit. Says the company: "Mobility is an extremely important factor in a shovel of this size. The Northwest has positive traction while turning as well as when traveling straight ahead, instead of the "block and skid" method of steering that slides one crawler and sets up enormous side strains when turning.

"The dipper on this model is of full manganese construction and simplified design. There are no track gears or pinions to require constant repair, adjustment or replacement."

The power plant for this machine is a heavy duty 8 by 9-in. Northwest Twin City engine, chosen for its comparatively low fuel consumption. The power take-off is through a flexible coupling to helical gears mounted on ball bearings and running in oil. Cone type Northwest swinging clutches are utilized. The double diameter roller path made possible by the use of hook rollers in addition to the standard rotating rollers is also a feature.

No matter how tightly the Northwest cushion clutch on this machine is adjusted,

Booklets describing shovels

according to the company, it transmits full engine power, but at the same time reduces stress on every part under power when the hoist type rope is tensioned; it reduces maximum loads on the drum shaft by 50% and drum clutch adjustments three to five times.

Welded dipper stick construction is a major feature of the 1¼, 1½ and 1¾-yd. shovels made by this company. The dipper door is of rigid one-piece construction with dipper back of heat-treated nickel alloy steel casting. The strength of the boom is credited to the welded construction, and the simplified shipper shaft design and improved dipper construction are developments of real interest.

Full specifications including length of shovel boom, length of dipper sticks, boom angle, maximum dumping radius, dumping radius at maximum height, clear dumping height, clearance radius of boom, clearance height of boom, maximum cutting height, depth of cut below floor level, are all included in the full specifications for each of the shovels described in the Northwest Engineering Co.'s new booklets.

The background of experience in shovel design and manufacturing is summed up in the company's assertion that "the Northwest Engineering Company is the world's largest exclusive builder of gasoline, oil burning and electric powered shovels, cranes, draglines, pullshovels and skimmer-scoops."

FUSE LIGHTERS

Simsbury, Conn.—The Ensign-Bickford Co., maker of safety fuse, describes its modern product as follows:

"In our safety fuse the powder core burns

inside the wrapping. It isn't like firecracker fuse. You can't see the fire run along it. Some fuses emit smoke through the wrapping as the powder burns, but with other popular brands the only indication of the lighted fuse is 'end spit' and smoke rising from the lighted end of the fuse.

"Whether you do a lot of blasting or not," warns the company, "get fuse lighters. They're made especially for the job of lighting safety fuse and will save much time and worry. The safety fuse match lighter is a short paper tube that can be slipped over the freshly cut end of the fuse. One end of the tube is coated with the material that safety matches are made of. When you're ready to light the fuse, strike the tube with the edge of a safety match box or light it with a match flame.

"Complete instructions for preparing primer cartridges and for blasting rock, gravel pits and etc., are contained in pamphlets which you can obtain free from your powder company or through the Ensign-Bickford Co."

Joseph R. Ensign is president and Robert Darling vice president of the company. Other officers are as follows: H. E. Ellsworth, vice president, J. K. Brandon, secretary, C. R. Seymour, treasurer, R. E. Darling, assistant secretary and J. E. Ellsworth, assistant treasurer.

SHOVELS

Lima, Ohio—The Ohio Power Shovel Co. offers the user of excavating machinery an excavator that will fit many different requirements. The complete line includes gasoline, electric and Diesel shovels, draglines and cranes in sizes ranging from ¾-cu. yd. to 1½-cu. yd. capacity. These types are designated as the Type 302, ¾-cu. yd. shovel or 12-ton crane; Type 404, 1-cu. yd. shovel or 16-ton crane; Type 502, 1¼-cu. yd. shovel or 20-ton crane; Type 601, 1½-cu. yd. shovel or 25-ton crane; and Type 101, 1¼-cu. yd. shovel.

"All of our machinery," says the company, "including the four cone rollers, drums and shafts used, operates on tapered roller bearings, a feature pioneered by Lima. All of the gears in the machinery, with exception of bevels, have helical cut teeth, another feature pioneered by Lima. The combined advantages of helical gears with shafts mounted on roller bearings result in a smooth, noiseless, economical, almost frictionless long-life excavator.

"The drums are of extra large diameter and are mounted on a single shaft. All drums are equipped with tapered roller bearings, not only to make them roll easier, but to keep them always central with the clutches; therefore affording velvety action of clutches and brakes at all times.

"Our synchro-power clutches are of new design and are easy to operate, responding smoothly to the slightest motion of the control levers. It is impossible to have chattering and grabbing clutches, due to application of roller bearings in the drums. All operations are independent, therefore making it possible to hoist, crowd, travel, swing, steer, and raise or lower the boom, all at the same time."

The Types 302, 404, 502 and 601 are equipped with chain crowd and chain propel. For those who prefer the cable crowd to the chain crowd LIMA offers the Type 101.

The Types 302, 404, 502 and 601 have outside dipper handles of box type construction said to be strong enough to withstand all strains and stresses encountered in hard digging. The dipper is cast in one piece of manganese steel with detachable lip. Bulletins illustrating and describing LIMA'S complete line will be sent upon request.

MANGANESE STEEL

Carlisle, Penn. — Rock product industries continue to be a major outlet for the manganese steel and equipment of the Frog, Switch and Manufacturing Co., founded here in 1881 by John Hays, father of the present president.

In the sand and gravel field, centrifugal pump shells and impellers weighing up to 12,000 lb., side plates, throat liners, hull pipe and cutter heads of many sizes and designs are being made by this company.

The stone crushing industry is a steady "customer" of "Indian" manganese steel. Jaw plates, cheeks, toggle, bearings, mantle heads, concaves, chute liners and gears for every known make of jaw and gyratory crusher are produced by this concern.

An official of the company, referring to the extremely severe service which excavating shovels are subjected to in rock quarry work, says, "we are proud of the record made by 'Indian' manganese steel dipper teeth of Carlisle design—and our treads, rollers and sprockets.

"We have many customers who have been with us for many years who are well satisfied with Carlisle teeth. They are made to fit all makes of excavator shovels. We also make solid teeth for drag scrapers, grab buckets, etc."

The Indian brand of manganese steel, now 20 years old, has been used for some time on such cement mill machinery as ball and tube mill liners, pulverizer hammers, grate bars, conveyor chains, etc.

General offices, as well as works of the Frog, Switch and Manufacturing Co. are located at Carlisle, Penn. Names and addresses of sales agents follow: E. L. Pemberton & Co., 60 East 42nd St., New York, N. Y.; H. A. Johann, 503 Rialto Bldg,. St. Louis, Mo.; Production Manufacturing Co., Park Bldg., Pittsburgh, Pa. and S. B. Maximon, 1511 13th St., Altoona, Pa.

Ohio power shovel in action

EXCAVATING AND DRILLING

South Milwaukee, Wis.—With the recent purchase of the Armstrong Manufacturing Co., the Bucyrus-Erie Co., has brought together business experience and products that admirably supplement each other. The Armstrong Manufacturing Co. with 66 years experience in the building of drills with a line known for speed and dependability, now is coupled with Bucyrus-Erie with its background of 53 years experience in the building of excavating machinery and operating a complete set of well equipped factories, foundries, heat treating plants, metallurgical laboratories, etc.

The close relationship between drilling and loading operations on excavating projects makes logical their common manufacturing and merchandising. George R. Watson, formerly president of the Armstrong Manufacturing Co., now is associated with the Bucyrus-Erie Co. as manager of the drill business.

For mines, quarries and large construction jobs the company recommends its Bucyrus-Armstrong No. 29 blast-hole drill. Features of this unit designed to insure low cost operation, include an all-steel frame on Caterpillar mounting, twin disc clutches, steel gears, steel pitman and all-steel bull-reel and sand-reel, all steel derrick, shock-absorbers, rubber-insulated sheaves, double row roller-bearing pillow blocks, two adjustable tool-guides and bull-reel brakes. Safety guards, worm-gear feeds, belts, pressure grease lubrication throughout and 18,500 lb. weight, also are among the specifications of No. 29.

This all-steel drill is designed to carry drill stems of 4¼ in. diameter by 20 ft. long with bits for drilling 8-in., 10-in., or 12-in. holes. It handles a string of tools, weighing 2,200 lb. and is recommended for blast hole drilling

where the smaller No. 26 drill is not large enough and where the added expense of a still larger drill is not desirable. The Bucyrus-Armstrong No. 26 all-steel drill is designed to carry drill stems of 3½ to 4¼-in. diameter by 20 ft. in length.

The Bucyrus-Armstrong No. 29-T will handle a string of tools weighing 3,00 lb. or more with a 6-in. by 20-ft. drill stem and 600-lb. bit for drilling 9-in., 10-in., or 12-in. diameter holes. Quarrymen use this equipment for extremely hard rock drilling at sources of large tonnage capacity or for difficult rock moving jobs where ruggedness in drilling equipment is imperative.

SPEED AND STRENGTH

Milwaukee, Wis.—The Harnischfeger Sales Corp., distributor of P. and H. electric traveling cranes, grab bucket cranes, monorail hoists, gasoline, electric and Diesel shovels, cranes, draglines, etc., for the Harnischfeger Corp., refers to the P. and H. Model M2 rock loading shovel as "the newest development in this class of machinery.

"This sturdily constructed 1½-yd. machine," says the company, "combines fast operating speeds with condensed construction, thereby permitting maximum output with minimum clearance. The M2 is a full revolving unit mounted on a crawler traction capable of withstanding heavy digging. The crawler traction may be easily converted to rail mounting if desired.

"Rock quarries will find this speedy, three-motor electric shovel a large producer even under the most severe conditions. Its simple design, sturdy construction and ease of operation make it the ideal machine for profitable quarry loading."

The main frame is of heavy welded steel construction, thoroughly ribbed and braced throughout. The crawler frames are likewise of heavy welded steel construction and the crawler links, sprockets and rollers are of alloy steel castings.

Executive personnel of this company consists of W. Harnischfeger, president; D. B. Patterson, vice president; H. S. Strouse, treasurer; and A. W. Coppin, secretary.

WIRE ROPE

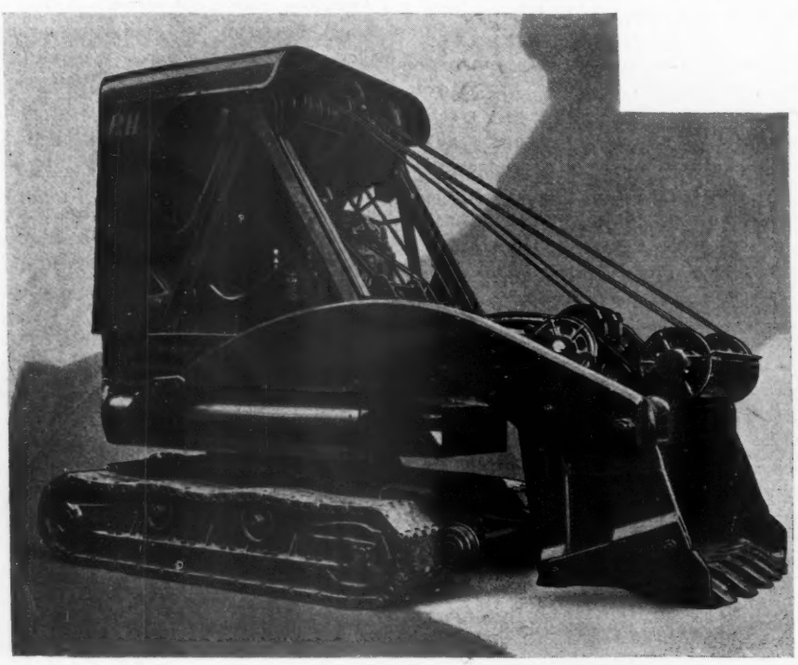
St. Louis, Mo.—A. Leschen and Sons Rope Co., manufacturer of Hercules red-strand wire rope, has published a booklet entitled "Practical Information on the Use and Care of Wire Rope," of which thousands of copies have been distributed. A revised edition of this booklet is just off the press, and its publishers will be glad to send a complimentary copy to any individual or company interested in getting maximum returns on their wire rope investment.

VIBRATING SCREENS

Racine, Wis.—During the past two years the line of vibrating screens produced by the Universal Vibrating Screen Co. has been complete for the separation of all materials from 2½-in. clear openings on down to 100 mesh. "Through improvements in design and construction," says an executive of the company, "the efficiency of Universal screens has been increased to a degree never before thought possible, while the rugged construction insures still more dependable operation than ever before. The Type C 36 by 58 ins.-unit, especially designed for service at discharge ends of conveyors and under bins, has proven to be an exceptionally popular model through its ability to handle large capacities on the most difficult materials to separate.

"We are members of the NRA, and while we have always paid good wages to our help so that no changes would have had to be made in that regard, we have advanced wages 15 per cent and reduced the time per week for each employe so as to do our part in helping the re-employment program."

Officers of the company are: Knud Hansen, president; A. L. Bengtson, vice president; A. L. Adrianson, secretary-treasurer, and general manager; Wm. Birchmeyer, general superintendent.



Modern design in P and H, M-2 rock loading shovel

HYDROTATOR PROCESS

Cleveland, Ohio—Summing up seven years of progress in developing its Hydrotator process, the Hydrotator Company says: "While the process was originated in the gold milling field it is only in the past five years that it has been developed for hydraulic classification. Its high classifying efficiency made possible the Hydrotator concentrating process. It is mainly used in cleaning fine sizes of coal where it makes an extremely clean separation of coal and slate. During the past four years upward of 45 installations have been made in the anthracite region.

"In 1932 the Hydrotator principle was applied in the Minnesota Iron Range for classifying fine iron ore. This led to the design of the two-stage Hydrotator. This has during the past year been successfully applied in the anthracite coal region where the two 16-ft. classifiers are making a 40-mesh separation on 200 tons per hour of anthracite-slush (10 mesh to 0). The 40-mesh which is about 50% of the solids passes over the overflow with about 5,000 g.p.m. of water. The underflow (10 to 40-mesh) goes to a Hydrotator coal cleaning machine which turns out 60 tons per hour of low ash coal.

"Also during the past year the two-stage classifier has been in operation in Ontario gold fields with remarkable results.

"The introduction of flotation has made it necessary to classify at a finer mesh. The Hydrotator is, for example, making an overflow product of 15% solids and 98% minus 200-mesh on a minus 40-mesh feed. The underflow is 70% solids and contains less than 8%—200-mesh material. The following screen analysis illustrates average results obtained in a similar case.

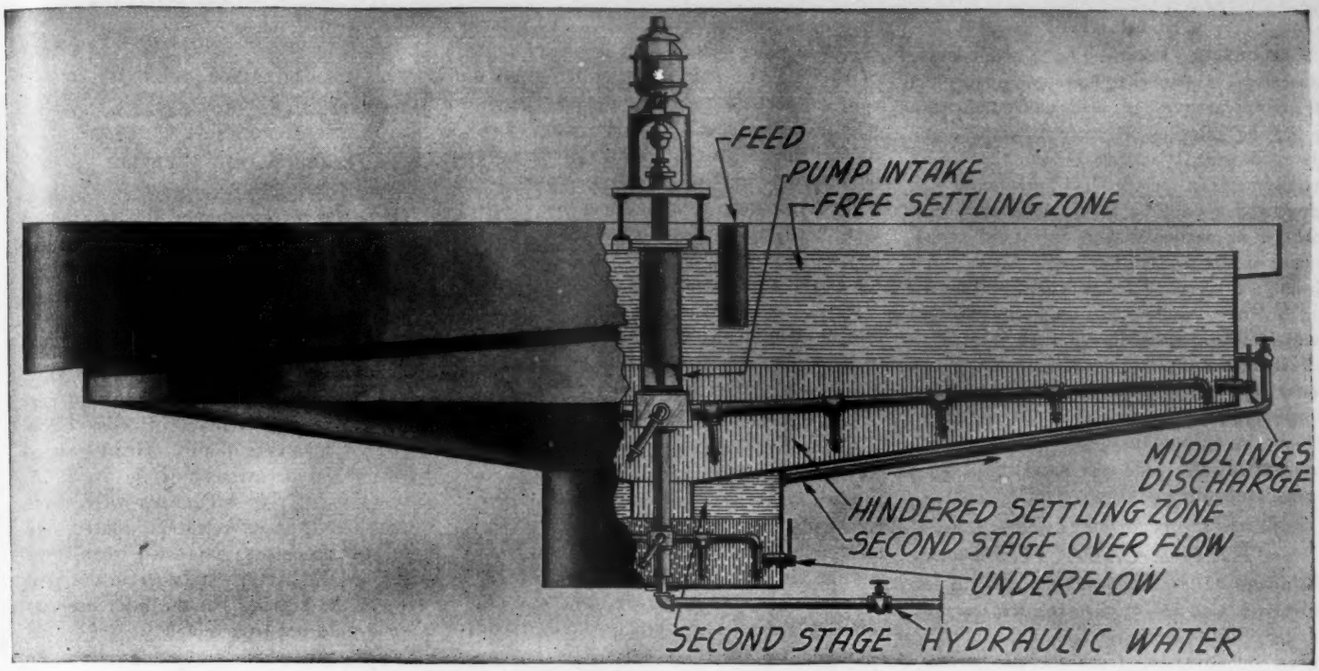
PERFORMANCE OF HYDROTATOR CLASSIFIER AT WRIGHT-HARGREAVES MILL

Screen Analysis:

Mesh	Feed % Weight	Overflow % Weight	Underflow % Weight
+ 35	.4	....	2.4
+ 48	1.1	....	5.5
+ 65	2.8	....	14.0
+ 100	8.9	....	41.0
+ 150	8.7	....	20.5
+ 200	13.8	3.2	8.8
— 200	64.3	96.8	7.8
Total	100.0	100.0	100.0

Overflow density—14.5% solids.
Underflow density—70.0% solids.

"The Hydrotator Company now has developed the air-sand process, a dry method of cleaning bituminous coal which has attracted much attention during the past year; In this process, dry sand is aerated by passing through an inclined trough. Low pres-



Two-stage axiflow Hydrotator

sure air is introduced through porous plates in the trough bottom. The result is a stream of sand, six or eight inches deep, flowing through the trough like water. Coal, or any other light material floats in the sand stream, passes over the overflow and the sand is screened and returned to the feed end.

"Heavy material (slate in coal) sinks and is trapped out by suitable means at three successive points in the flow. This also is screened from the sand, which is returned to the feed end. This process can be used for the dry separation of any materials, specific gravities of which are such that the gravity of the separating medium is intermediate between those of the materials to be separated. For instance, the gravity of bituminous coal may be taken as 1.35; that of slate as 2.60. Using silica sand it is possible to maintain an effective gravity in the flowing sand of from 1.40 to 1.70. Under these conditions the coal will float and the slate sink. All that remains is to make a mechanical separation of the sand from the coal and slate."

The Hydrotator Company was organized by E. B. Day, president, and W. L. Remick, secretary-treasurer and general manager. Thomas Fraser, inventor of the air-sand process, is in charge of the air-sand sales. R. A. Riley is in charge of the anthracite office in Hazleton, Penn. The main offices are at 12435 Euclid Ave., Cleveland, Ohio.

Operators in the rock products industries may well adapt the Hydrotator's efficient method of classification to a wide range of projects, according to engineers who have studied its possibilities. Higher classifying efficiencies today are of greater importance than ever now that competition is being taken out of the price realm and placed on a plane where sizing specifications, etc., count for their maximum.

The large illustration of the two-stage type Axiflow Hydrotator is representative of successful installations where concentration is preceded by desliming, or where a middling product is to be made for subsequent treatment.

The upward current indicated in the auxiliary tank is due, says the company, "to the unique introduction of hydraulic water by means of a pipe and agitator. The heavier or larger solids settle into the auxiliary tank, where they meet an accurately adjusted, uniform upward current. The upward current can be adjusted to settle and discharge material of any size or gravity at a definite point. Lighter or smaller particles rise and are held in suspension below the pump intake in main tank, to be discharged at will from a convenient valve.

"The finest and lightest material is discharged over the overflow of the main tank. By making the main tank sufficiently large it will overflow clear water or solution—thus obtaining the effect of a thickener and classifier combined. This machine likewise performs the combined duties of a deslimer and concentrator. In such cases the material is deslimed, a finished concentrate is made from underflow and as many middling products as desired are drawn from different levels in the main and auxiliary tanks. Since the Hydrotator approaches perfection in its classifying action you may expect to improve your process wherever the Hydrotator is applied—whether in classifying, desliming, thickening or in any of the numerous operations involving the treatment of solids suspended in liquids.

"It is unusual to consider a hydraulic classifier as a concentrator, because until now no classifier has been able to maintain perfect hindered settling conditions. The Hydrotator does exactly this. It makes a close gravity separation and has a tremendous capacity. As a thickener the Hydrotator has a much greater capacity per unit of area than the 'settling tank' type of thickener."

CONVEYORS, SCREENS

Aurora, Ill.—Stephens-Adamson Manufacturing Co., conveyor and screening manufacturer of Aurora, Ill., reports considerable engineering and development activity during the past months. Two new catalogs have been issued, No. 33 to describe the S-A line of screening, washing and conveying equipment for sand and gravel plants, and No. 34 covering S-A equipment for crushed stone plants.

A new type of portable washing and screening plant has been developed, built on the unit principal. It consists of: Conveyor, crushing, screening, washing, and storage bin units which can be bought and arranged to suit the immediate job on hand.

The S-A vibrator screen has received a great deal of attention—a new quick-change screen panel and method of stretching screen cloth has been adopted. A new folder has been published to show the entire line of S-A washing, scrubbing and de-watering equipment.

There have been few changes in the S-A organization, except that Jack Fasmer, who has served as shop superintendent, erection engineer and manager of the St. Louis office, now heads the S-A sales-engineering forces.

SCREENS

Carbondale, Penn.—The Cross Engineering Co., from its plant here, or through its representatives in principal cities, continues its offerings of screen sections and plates designed particularly for the severe requirements in rock product operations. The company's special C. M. 5 metal is recommended in particular for operators' round, square or slot perforation specifications; high carbon, or special analysis steels for punching to meet individual requirements are available from this concern.

Installation of Cross perforated screen sections, plates, elevator buckets, conveyor troughs, flights and chutes is suggested by company engineers to meet "increased production demands made necessary by the government's public works program."

"EXTRA CAPACITY"

Chicago, Ill.—Raymond Bros. Impact Pulverizer Co., in offering the whizzer revolving ejector device which automatically throws out oversize from the air stream, claims that it "sets up a new standard of performance in the separation of powdered materials."

"Raymond mechanical air separators," says the company, "with the patented Whizzer are giving such superior results that they are attracting wide attention among engineers in the lime, gypsum, and cement industries. In a typical test, classifying clinker, a 16-ft. separator without whizzers produced 113 bbls. per hour of finished material at a fineness of 90% minus 200-mesh, taking the feed from the pulverizer at 75% minus 200-mesh. After the machine was equipped with whizzers, the output reached 155 bbls. per hour at 90.6% through 200-mesh, handling the same feed as before.

"This 37% increase, due to whizzer action alone, checks with results in a similar plant, where 38% higher capacity was obtained from a 14-ft. whizzer separator. Another plant, using two 14-ft. whizzer separators on raw mix, reported vastly bigger output, estimated above 50%. Performance has demonstrated the merit of the whizzer principle, and success has invited imitation—but there is only one whizzer-type separator, based on the original Raymond patents, and built with the latest Raymond improvements, insuring maximum efficiency in classifying materials. For extra capacity, cleaner tailings, greater uniformity and lower cost production, specify Raymond Mechanical Air Separators with patented whizzer."

CEMENT-MAKING UNITS

New York, N. Y.—F. L. Smidth and Co., manufacturer of cement making machinery, emphasizes the advantage to the plant operator of keeping mechanical efficiency at par through the "parts service" of the manufacturer long established in the field.

"When obtaining repair parts," says this concern, "remember that the manufacturer of the machine for which they are intended has gained experience with many similar machines in other plants—that he is constantly making improvements in those parts based on this experience—that his shop is equipped with tools specifically for the manufacture of such parts—that he is interested in supplying parts that will assist in obtaining the highest efficiency from the machine itself—that the parts are usually made to templet, making easy changeability—and that many of the parts are patented."

F. L. Smidth and Co. design complete cement manufacturing plants, and stand ready to serve plant modernization projects as well.

PULVERIZERS, CLASSIFIERS

Allentown, Penn.—The Bradley line of pulverizers and air classifiers made by the Bradley Pulverizer Co. comprises: The Bradley Griffin mill (three sizes); a three-roll mill; a pneumatic mill; the Hercules mill, and the air classifier offered in fine sizes.

From this wide range of units, says the company, any stone producer may select equipment to meet his exact requirements. Capacities range from 1 to 50 tons an hour. Finenesses range from 20 to 350-mesh.

CENTRIFUGAL PUMPS

Baldwinsville, N. Y.—Morris solid-lined pumps, made by the Morris Machine Works, are specially built for handling highly abrasive materials such as sand and gravel.

"Special features of these pumps," declares the company, "assure long, efficient service with minimum maintenance expense. These points include the patented renewable lining of suitable alloy, simple sturdy construction, and many provisions for high efficiency, convenient adjustment and ready accessibility.

"These pumps, together with the many other Morris centrifugal pump types, are giving dependable and economical service in thousands of installations."

SAFETY

Trenton, N. J.—John A. Roebling's Sons Co., wire rope manufacturer, stresses safety as the paramount consideration before the buyer. A company statement on this subject reads as follows:

"Safety comes first with Roebling, in making wire rope and in recommending the grade and construction most suitable for each particular need. For it is the conviction of this company that safety is the primary requirement of practically every rope use.

"To insure Roebling rope of unsurpassed dependability: (1) The wire is drawn from the world's finest acid rope steel—custom-made by Roebling in *small* open-hearth furnaces. (2) Then it is fabricated and tested in one of the country's largest, most modern wire rope plants—to the exactingly high standards which have prevailed at Roebling for over 90 years. (3) And the finished rope is made available in a wide variety of types and designs, including right, left, alternate, Lang, preformed and non-rotating, in all degrees of rope and strand flexibility, so that each individual requirement may be *exactly* met.

"Our recommendations are based on performance-proved facts."

Lime Code Hearing

(*Concluded from page* 45.)

The labor representatives also insisted on striking out of the unfair practices "enticement of employes," on the ground that this restricted the opportunities for employment.

The deputy administrator questioned the unfair practice provision which would prohibit increase in productive capacity, stating that he believed adoption of uniform cost accounting and prevention of sales below cost would take care of this. He also stated that the legal department of the N. R. A. objected to it. No arguments were made by producers for its retention; indeed, two or three producers expressed themselves against it. No action was taken on this provision at the hearing, but the inference was that it would not be accepted.

The deputy administrator described the administrative machinery of the code as "too cumbersome."

The hearing was all over in a day; and the code since August 8 has been in the hands of N. R. A. for final action by the President. Up to August 23 nothing had been heard from it.

About 100 interested persons attended the hearing, most of them producers. Others included Otho M. Graves, chairman of the trade relations committee of the National Crushed Stone Association and the editor of Rock Products.

Trade Literature

Linestarters. A new leaflet on combination linestarters for squirrel cage and wound rotor induction motors, illustrates this development. Mounted as a complete, compact unit this line of remote controlled, non-reversing across-the-line type magnetic starters and disconnect switches with or without fuse mountings is described. WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., Pittsburgh, Penn.

Universal Joint. Leaflets describe the Rzeppa universal joint as a machine element especially adaptable to automatic work (e. g. Grico 2-axle drive) and include diagrams and tables on joint velocity. GEAR GRINDING MACHINE CO., Detroit, Mich.

Hard-Facing Materials. Increased life and savings effected through the application of hard-facing materials to the wearing parts of excavating and dredging equipment are described in a 16-page booklet, "How Hard-Facing Saves Money for Contractors." Several types of hard-facing materials are discussed including the non-ferrous cobalt-chromium-tungsten alloys and welding rods consisting of particles of crushed tungsten carbide bonded together with steel. HAYNES STELLITE CO., Kokomo, Ind.

Bearings. Anti-friction bearing recommendations and engineering data for application of Tyson cageless tapered roller bearings in mine cars and quarry cars, with both through and stub axles, inside and outside boxes. Reproductions of blue-prints detailing principles involved are included, and load capacity tables are given. TYSON ROLLER-BEARING CORPORATION, Massillon, Ohio.

Pipe and Fittings. New 56-page booklet contains data on Universal cast iron pipe and fittings. Illustrations show installation with pouring, calking and all joint-making operations eliminated. CENTRAL FOUNDRY CO., New York, N. Y.

Bevel Gears. A 48-page catalog, descriptive of spiral bevel gear reducers and spiral bevel gears, gives full data as to sizes, ratings and prices. D. O. JAMES MANUFACTURING CO., Chicago, Ill.

The HUSKIEST FRONT END ON ANY 2YD. SHOVEL

NORTHWESTS have the huskiest booms and dipper sticks of any shovels, size for size.

Compare this boom with other 2-yard shovels! Compare its massive, welded construction and its modern design which combine to give a strength unequalled on other shovels, size for size!

The cambered design permits maximum operating ranges—high lift and long reach!

Look at those rugged dipper sticks—and they are not weakened by being drilled for attaching racks, etc. Northwest Dipper sticks are wide spaced for resistance to twisting strains, and to further increase this resistance they are tied together at the upper end with a cap casting. This feature is an exclusive Northwest advantage not to be found on other 2-yard shovels.

Here is a shovel that will stand the gaff and meet the contingencies of rock digging with the ease of handling dirt.

The new features on the Northwest 2-yard shovel make it outstanding and put it far ahead of any other in the field. See it! Check over its advantages before buying. Weigh what its advantages mean in profit and then put it on your next job. Send for the new catalog.

NORTHWEST
ENGINEERING COMPANY

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines.

1702 Steger Bldg. 28 E. Jackson Blvd.
Chicago, Ill., U. S. A.

RP-9-25-Gray

ADDITIONAL ADVANTAGES:

- The Cushion Clutch
- The Feather-Touch Clutch Control
- Ball or Roller Bearings on all high speed shafts
- Helical Gear Drive
- Short Tail Swing
- Positive Traction on both crawler sides at all times
- Shipment on one flat car without major dismantling

NORTHWEST 1 CU. YD. SHOVEL

Rock Products

With which is Incorporated **CEMENT and ENGINEERING NEWS** Founded 1896

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September 25, 1933

TABLE OF CONTENTS

Small, Economically-Operated Gravel Plants.....17-20
By R. S. Brewis, M.C., F.I.Q.

Adjusting a Re-Crusher to Give Maximum Percentage of a Desired Size.....21-23
By Irving Warner

Price Control and the N.R.A.....24-25
By George P. Ellis, C. P. A.

Tennessee Cement Industry Sees Bright Future....28-33
Plans for federal development of Tennessee Valley find producers ready to meet all demands. By George I. Whitlatch.

The Steam Test of Portland Cement Mortar Briquettes 34-36
By A. E. Hiscox

New System of Small House Concrete Construction. 52-53
New opportunities for cement products manufacturers and cement and aggregate producers. By Edmund Shaw

Departments

Editorial 27
Chemists' Corner 34-36
Hints and Helps for Superintendents.....38-39
Financial News and Comment.....40-41
Digest of Foreign Literature..... 47
Traffic and Transportation.....48-50
Cement Products 52-53
New Machinery and Equipment.....54-55
The Industry 57-58

INDEX OF ADVERTISERS

A
Allis-Chalmers Mfg. Co.. 68
American Steel & Wire Co. 15

B
Babcock & Wilcox Co... ..... Back Cover
Bacon, Earle C., Inc.... 69
Bradley Pulverizer Co... 65
Bucyrus-Erie Co. 7

C
Chicago Perforating Co.. 69
Classified Advertisements 70–71
Classified Directory of Advertisers 62–64
Cross Engineering Co..... 67

E
Eagle Iron Works..... 70
Ensign-Bickford Co. 8

F
Fate-Root-Heath Co. ... 16
Frog, Switch & Mfg. Co.. 69
Fuller Co. 10

G
General Electric Co..... 14
Goodrich Rubber Co., B. F. 60–61
Good Roads Machy. Corp. .....Inside Back Cover

H
Harnischfeger Corporation 66
Harrington & King Perforating Co. ..... Inside Back Cover
Haynes Stellite Co..... 9
Hayward Company 69
Hendrick Mfg. Co..... 65
Huron Industries, Inc.... 67

J
Jaeger Machine Co..... 65

K
Keystone Driller Company 59

L
Leschen, A., & Sons Rope Co. ....Inside Back Cover
Lewistown Fdy. & Mach. Co. 68
Link-Belt Co. ....Inside Front Cover
Loomis Machine Co..... 70

M
McLanahan & Stone Corp. 70
Morris Machine Works.. 66
Morrow Mfg. Co. 66

N
Nordberg Mfg. Co..... 69
Northwest Eng. Co..... 1

O
Ohio Power Shovel Co... 70

P
Pennsylvania Crusher Co. 67
Plymouth Locomotive Works 16
Productive Equipt. Corp.. 69

R
Raymond Bros. Impact Pulv. Co. 13
Robins Conveying Belt Co. 68
Ryerson, Jos. T., & Sons, Inc. 68

S
Smidth, F. L., & Co..... 63
Smith Engineering Works 11
Sturtevant Mill Co..... 5

T
Traylor Eng. & Mfg. Co.. 4
Timken Roller Bearing Co. 12

U
Union Carbide & Carbon Corp. 9
United States Rubber Co. 3
Universal Vibrating Screen Co.....Inside Back Cover
Used Equipment 70–71

W
Wellman Engineering Co. (G. H. Williams Co.).. 68
Wilfley, A. R., & Sons, Inc. 72
Williamsport Wire Rope Co. 6
Wisconsin Motor Corp... 69

Telephone Harrison 1422-23

TRADEPRESS PUBLISHING CORPORATION
330 South Wells Street, Chicago, Illinois, U. S. A.

Telephone Harrison 1422-23

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SUBSCRIPTION—Two dollars a year to United States and Possessions. $4.25 a year to Canada (including duty) and $4.00 to foreign countries. Twenty-five cents for single copies

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